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Chuck, Chuckety, Chuckety, Chuck—or Clank, Clinkety, Clackety, Clank

THE sounds made by cars passing over special trackwork tell much as to the kind of maintenance that is being done on the cars. Cars in proper condition pass over rail intersections with a "chuck, chuck" that imparts to the mechanically tuned ear an evidence of tightness of parts and good solid body and truck mechanism—a noise that is not especially unpleasant to hear. On the contrary, poorly maintained equipment clatters and clanks and rattles over the special work and joints and produces noises that are exceedingly annoying and wearing on the nerves. The trackwork may also contribute to the clattering noises if it is in bad condition with loose inserts and bent switch tongues. And such trackwork certainly shakes the equipment to pieces so it will rattle worse.

Sleeping in a hotel recently in a city where the latter kind of maintenance is manifestly practiced, the thought came to the writer that such rattling, clanking noises certainly make one think of the junk yard and perhaps contribute more than we realize to the impression part of the public has that the street car is obsolete.

Moral: Tighten up. There is no necessity for such noises. The rattles can be taken out by proper attention to maintenance.

Preheating and Slow Cooling Assist in Welding Large Castings

THERE is a broad application for the welding of cast iron in electric railway repair work if we learn how welds can be made successfully. The difficulties that have been experienced come from the fact that cast iron is naturally brittle and weak, and the application of welding heat at one point while the surrounding metal remains cold creates forces and strains that are likely to make the weld unsound. Even if the weld holds, cracks in other portions of the casting may occur. It thus becomes apparent that means must be employed to avoid this irregular heating and cooling.

That this is practicable and successful is shown by the practice used in the shops of the New York & Harlem Railroad for welding large conduit yokes, given elsewhere in this issue. It consists of heating the casting by gas flames beforehand and while the weld is being made and cooling the casting slowly and uniformly.

Results so far indicate that the method is very successful. Special equipment is used in this case. The welding stand has gas burners incorporated for the preheating, and two annealing ovens have been constructed and equipped with adequate facilities for handling the castings into and out of the ovens.

Some railways have reported satisfactory results in welding large iron castings by temporarily surrounding the castings with brick and then applying heat by gas torches or a charcoal fire. The weld is then made rapidly and the casting is allowed to cool slowly before the bricks are removed. This rough method, of course, increases considerably the cost of the welding over that where special equipment is used, but special equipment may not be justified if only an occasional weld on a large piece is to be made. Methods may vary with different conditions, but preheating, rapid welding and slow cooling are essential to assured success.

The composition of the welding rods used is another factor in obtaining satisfactory results. Manufacturers of welding materials recommend the use of rods having not less than 3 per cent of silicon for welding iron castings. Silicon in sufficient quantity keeps cast iron soft and so the strains from cooling are reduced.

Merchant Has Vital Interest in Good Transportation

THERE have been so many cases in large and medium sized cities of the temporary stoppage of the trolley service through strikes or hostile political action that it is now possible with fair accuracy to predict what will happen. It was not so easy to do so in 1919, when the cars were withdrawn in Toledo and kept out of service for twenty-eight days. Then the possibilities—and limitations—of the jitney, the bus and the private automobile for conducting the local transportation of the city were not so fully known. Since the historic Toledo case, there have been a number of other instances of extended shut-downs, notably in Bridgeport, Des Moines, Saginaw and on the Public Service Railway in New Jersey. Now has come Akron.

In all of these instances it is found that the first members in the community to suffer material financial loss from the stoppage of the trolley cars are the large retail merchants. Of course the rest of the community also is greatly inconvenienced, but those who have to travel can make shift for some time without a great deal of discomfort, if the weather continues good, by using various nondescript public and private conveyances. In the meantime, those who do not actually have to travel stay at home. But the retail business in the center of the city is entirely dependent for its prosperity on good local transportation facilities between the center of the town and the residential districts. Most of the customers of these stores are women, and if they cannot reach the down-town store comfortably, a great many of them will buy their necessities from a neighboring store or mail order house and will postpone the rest of their purchases. Some may telephone their orders, but if the average department store had to depend for its business on its telephone sales, it would soon be obliged to close its doors.

Hence, it is significant that the retail merchants in Akron have already raised a strong protest against the

stupidity of the Mayor, which brought about the present unfortunate situation. The trolley cars in Akron are now being seen in their true light, i.e., as the means by which the commercial life of the city is kept going. Ultimately, of course, the cars will have to come back. Akron is too large a city to be able to get along with buses only. But when the cars resume service it will have to be under much more favorable conditions than existed before the present trouble.

Electrification at the A. I. E. E. Meeting

THE low availability for service of the steam locomotive was stressed as one of the principal problems of steam operation at the transportation meeting of the American Institute of Electrical Engineers, held at Philadelphia, Feb. 5. Figures presented showed that the availability factor of the steam locomotive is somewhere between 25 and 45 per cent on various roads, while for the electric locomotive the factor is, from Norfolk & Western service records, 85 per cent.

The time required for turning the engine at the end of the line, for the electric, is little more than that needed for uncoupling it from one train and coupling it onto another. The steam engine, on the contrary, has to be taken to the roundhouse, have its fire dumped, the water drawn off, the boiler washed out and minor repairs made. Then it must have its boiler filled and a new fire built before it can go out on the road again. While great steps have been made in recent years toward increasing the length of engine divisions, particularly by the use of oil-burning engines, and so reducing the frequency with which this turning operation has to be performed, still it takes a not inconsiderable portion of the total time, and so reduces the availability.

Another factor that was brought out at the meeting is that when the greatest demand comes on the system the electric locomotive is especially effective. The case of the New Haven Railroad, which has extreme peaks to handle in connection with football games in New Haven, was cited. Then each year every electric locomotive owned is in service and is kept running just as long as it is needed to handle the traffic. Such continuous service is not practical with the steam locomotive, and hence more steam locomotives are required to handle a heavy peak than electric. Similarly, the annual heavy traffic season can be handled under electric operation with comparatively less investment in locomotives than with steam, because the electric moves the trains faster and is tied up for repairs and inspection for a so much smaller part of the time. In other words, the extra investment required to handle peaks, both seasonal and special, is substantially less for electric.

There seems to be a feeling on the part of some steam railroad men that the electric locomotive still is an untried machine, and that it is necessary to electrify an entire main line division before any really conclusive evidence can be obtained for or against it, as practically all accounting is by divisions only, with no segregation of the electric from the steam where both are used on a division. The figures that were cited as to what electrics already have done do not bear out this contention. On the Norfolk & Western, for instance, the electric locomotives have done more than the most modern steam operation ever was able to do. They have moved a greater tonnage per train and per day, have done it with less delays and failures on the road, and at a lower cost. Furthermore, the electrified section, which under steam operation was the limiting point of the system, now has ceased to determine the capacity of the road. On the Chicago, Milwaukee & St. Paul installation many of the limitations due to heavy grades, tunnels and bad coal have been eliminated, so that the capacity of that road is materially greater than before electrification, particularly in winter.

If the attitude of the steam men is to be that the case for or against electrification cannot be proved until an entire division is electrified, it would seem that there will be no real progress until some railroad has the foresight and the courage to go ahead and make such an installation. Are railroad men going to leave it to Henry Ford to show the way on the D. T. & I.? There are numerous divisions where electrical engineers estimate that large savings can be made. One was cited at the meeting where, after figuring charges of every sort, a profit of 15 to 20 per cent could be shown on the investment. Certainly with such a margin the risk cannot be very great.

Nor is it necessary to wait until a perfect locomotive is developed for electric service. The only way to learn to swim is to jump into the water. Experience covering nearly thirty years has developed a number of types of electric locomotives good enough so that they have given more than satisfactory service under nearly all conditions of traffic. High-voltage, low-voltage, alternating-current, direct-current locomotives can all be used.

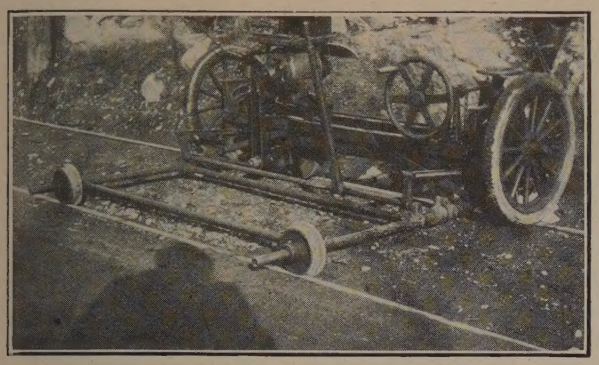
Altogether, it seems that the engineers have been prone to hold the penny so close to the eye that the sun is obscured. Small details and cost figures pertaining to the electrified division only seem to have kept them from seeing what has been pointed out, namely, that the main value of electrification is the increased use of the entire railroad plant and the higher earning power of the system as a whole which it makes possible.

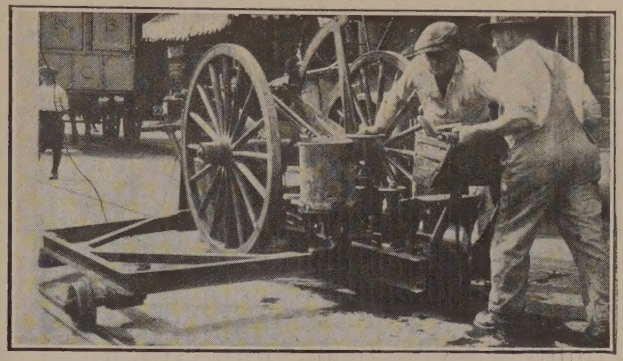
It Pays to Lay Out Maintenance Work in Advance

IT STANDS to reason that much more can be accomplished by a given expenditure of time and effort when the work is carefully laid out in advance and is conducted along a logical plan of procedure. Sad to relate, this practice is not followed on all electric railway properties. As one maintenance engineer remarked to the writer, "Why worry and waste effort before you know that anything is wrong?"

One large Eastern property followed this haphazard practice for years, and not until it had passed through a receivership and a reorganization was the fallacy of the procedure recognized. Nevertheless, that much can be accomplished along these lines is well shown in the article by Frank B. Walker elsewhere in this issue.

Much of the gain is not from the improved equipment alone, but from the careful planning of the season's work well ahead of time, so that each machine could be in use for the longest period possible, and the men could be kept working steadily. This meant that a smaller amount of equipment had to be purchased and a smaller force hired. With the smaller number of men to train, of course they attained expertness and were able to do more and better work. The gain to the company has been very considerable, not only in cost but in performance, and through that, in improved public esteem.





Universal Rotary Grinder and Reciprocating Grinder at Work on Eastern Massachusetts Street Railway

Applying Quantity Production Methods to Maintenance of Way

Construction Forces Organized According to Manufacturing Practice to Obtain Intensive Use of Track Machinery on Eastern Massachusetts Street Railway — Selection of Proper Equipment for Diversified Jobs Is Important—School for Training Men to Do More and Better Work Found Helpful to Economical Maintenance

By Frank B. Walker

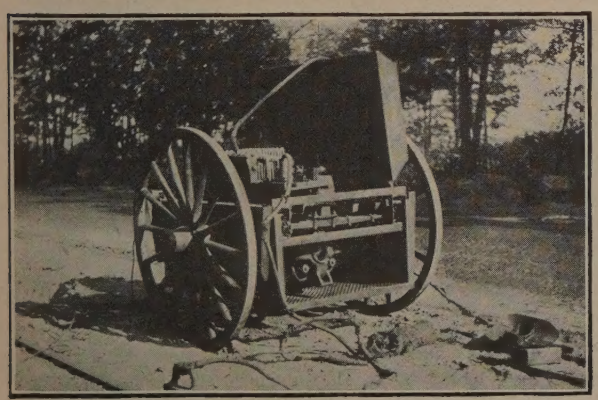
Chief Engineer Maintenance of Way, Eastern Massachusetts Street Railway

IN THE rehabilitation and maintenance of its 680 miles of track, the Eastern Massachusetts Street Railway has recently adopted machinery and methods which have greatly expedited the handling of the work. Substantial savings in labor and material have been accomplished.

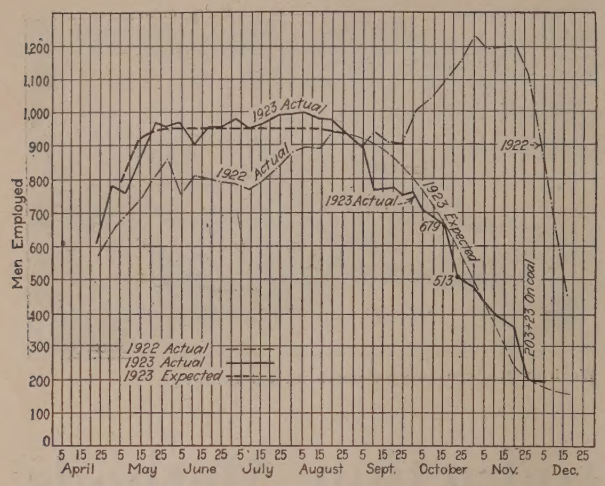
When the public trustees took over the property in 1919 the track and roadbed were in poor condition as a result of long-deferred maintenance during the war and during the period when the company was in receivership. A comprehensive plan of way betterment was started late in the summer of 1919. The carrying out of the program has involved the organization of the work on a divisional basis, the acquisition of various types of track equipment, and the thorough training of the departmental personnel in the use of improved equipment for track repairing. Close attention to enlarging the force in the spring and summer and reducing it again in the fall, as shown on an accompanying chart, has greatly increased the efficiency of the work.

In order to keep machinery going all the time, several things are necessary. First, the amount of work to be done must be known in advance. The Eastern Massachusetts Street Railway works on a budget system. From the general budget the track department calculates its various jobs and details the items of work to be done. The number of men to be employed and the amount of material to be purchased must be determined, and a definite schedule is necessary in order to assign machinery to the several divisions and to prepare a working program for this equipment. After this has been done, the various jobs are formally and systematically authorized. Charts are prepared showing the progress expected during the season of different items of work, such as seam welding, joint grinding and surface welding.

A close study is made of the progress of each division, and when one division has failed to keep up to the anticipated rate, inquiries are immediately started to determine the difficulty. It is found occasionally that



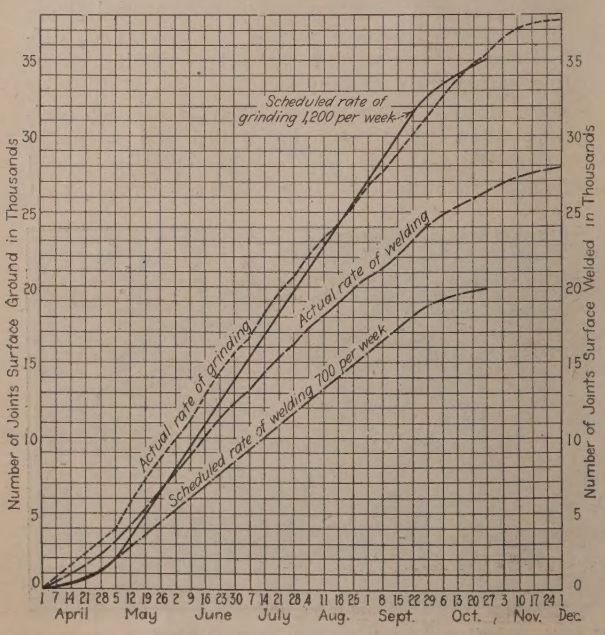
The Company Used Two Types of Welders, the Dynamotor Type, at Left, and the Resistance Type, at Right



Labor Chart for 1922 and 1923

work has not been opened up in sufficient time to keep up the anticipated rate; sometimes material has not been ordered or delivered in time, machinery may have broken down, or production may have fallen off for some other reason. However, the department accepts no alibis for failure of production. Even labor conditions or machinery failures are not always considered adequate excuses.

The rate of production is set high, but certain allowances are made for unexpected contingencies. It has been found in general that if the men directly in charge of the work correctly anticipate their wants so far as ordinary material is concerned, production can be kept at high speed. Ratings are given by the engineering department to several types of machines. For example, in seam welding of T-rail with 24-in. joints, a rate of ten joints per welding handle per nine-hour shift is expected. With 30-in. joints the rate is nine, and with 36-in. joints it is eight. On girder rail, the rate of welding per handle per shift is seven joints when they are 24 in. long, six joints when they are 30 in. long, or five joints when they are 36 in. long. In grinding, the schedule calls for eighteen surface welded joints or thirty-six other joints per grinder for each nine-hour day.



Scheduled and Actual Joint Grinding and Welding, 1923

Unless a definite daily quantity of work is assigned, the desired production for the season cannot be obtained, nor can it be determined whether or not gangs are working efficiently. The question has sometimes been asked, why were only a few items selected for this quantity production? The answer is that in repairing, overhauling or reconstructing a track, the last thing done is the joint work. Those items, such as joints, which are selected as standards for measuring production, represent a finished product. It is necessary for the forces to put in ballast, do the lining and surfacing, ditching, tie renewals and all other miscellaneous work, except paving, before the joints are finally finished.

Complete reports are prepared by each division for the general offices twice a week during the construction season, detailing the work done and also showing the amount per half week and the total to the date of the report. Where slowness appears in a particular job after an analysis, special attention is given by sending out instructors, or in some cases engineers, to inspect the work closely. In other cases of more important problems, the chief engineer gives his personal attention to bringing up the quantity of work.

Progress charts are kept, showing for any given date the number of joints welded up to that time and the number ground. On these charts are shown also curves for the estimated rates of progress, so that it can be seen at a glance whether or not the work is proceeding according to schedule. This close supervision is necessary in order to accomplish such a large amount of maintenance work over scattered divisions.

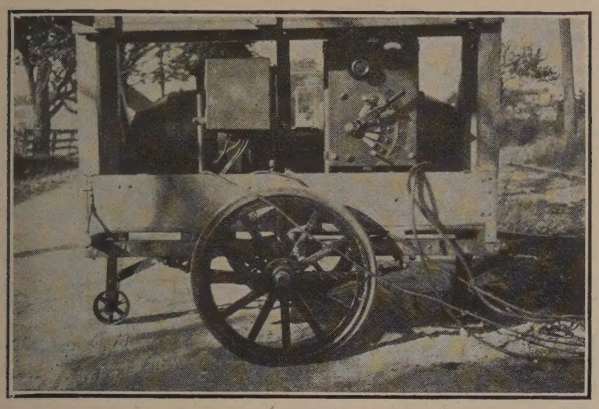
IMPORTANCE OF HAVING THE RIGHT MACHINERY

To keep the track maintenance equipment continuously in use during the entire season has been the aim of the railway. It is the policy to purchase all machinery necessary to do the work properly and efficiently, provided such equipment can be used throughout the entire working season. Machinery, even though of proper design, is of little value if it can be used only a small portion of the time.

Equipment used by the track department must be portable, rugged and simple, not only in its operation but in its maintenance. It must also be well protected against the weather and should have parts which can be readily detached, covered, or fastened on so securely that they cannot be stolen, as the machinery must be left along the roadside in many instances. There is room for still further development of portable track machinery. Manufacturers should not attempt to adapt shop equipment for use of the track department without being sure that such machinery can stand the extra heavy service brought upon it by use under all conditions of weather, sand and dust storms, and being operated by men who are not mechanics.

Due to the wide separation of jobs on the system, which covers both city and country areas north and south of Boston, the company did not purchase the larger pieces of track maintenance equipment available on the market. Such purchases would have resulted either in excessive investment or in too much idle time and difficulties in meeting local demands for the service of particular large units.

The gradual purchase and installation of track maintenance machinery followed recommendations by the engineering department after more or less extended research and experiment, working out the machine use



Shop Welder on Wheels for Outside Use. Tool Box on Roof

Track Air Compressor Mounted on a Ford Truck

through a system of reports, and including sending out instructors and conducting a winter track school.

The equipment finally purchased and in use on the Eastern Massachusetts Street Railway includes twenty-four rail joint seam welders, of which twelve are of the Rail Welding & Bonding Company Type WW, six are the same company's Type B, five are General Electric shop welders mounted on trailers, and one is a Westinghouse shop welder also mounted on a trailer.

All these machines with the exception of the Type WW are limited by their capacity to the use of one welding handle. The capacity of the latter is sufficiently great to permit two welding handles, so that there are thirty-six welding handles with twenty-four machines. All of these seam welders are of the so-called "dynamotor" or "motor-generator" type, permitting reversal of the polarity of the arc. The surface welders used by the company are all resistance machines of the direct polarity type and consist of ten Indianapolis welders, five Erico welders and nine Ajax welders. For grinding the joints there are twenty-four Universal joint grinders and six Seymour "Midget" grinders, as well as ten reciprocating grinders for grinding corrugated rails.

Vertical rail benders are used to a considerable extent, forty-seven having been made by the company.

Eighteen electric tie tampers of the Jackson type, having 4 tamper units each, are used. Compressed air is provided by two Ingersoll-Rand portable compressors, each mounted on a Ford chassis. These are used for tie tamping and operating concrete breakers.

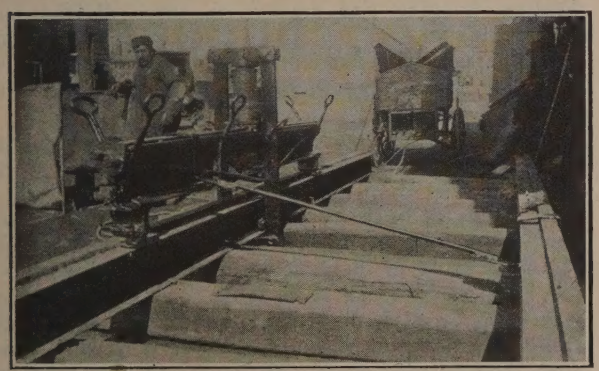
Other equipment used includes a Racine electric rail saw, a "Nut cracker" clamp designed by the company for holding plates in place while welding, an electric brush for cleaning rail joints, and an electric hammer for cleaning rail joints. These two latter machines were used for experimental purposes.

The company also has twenty-four acetylene cutting torches, forty track drills and various other small units of the usual type.

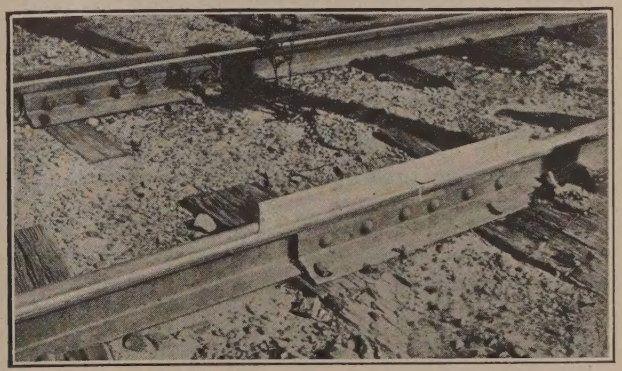
The theory upon which the engineering department works is that poor trackwork is just as likely to be the fault of the supervisory forces as it is to be the result of incompetence or unwillingness on the part of the workmen. Old methods of doing trackwork were apparently satisfactory up to a few years ago, there having been few changes for a number of years. More recently, however, maintenance methods have been much modified by the development of certain types of machinery such as welders, grinders, rail benders, mechanical tampers, etc.

It is hardly to be expected that foremen and trackmen should be familiar with the newer methods and be able to get the desired results without special instruction. On the Eastern Massachusetts the training of these men has been combined with the instructions of the supervisory forces, including managers, superintendents, engineers and roadmasters, as well as foremen, sub-foremen, welders, grinders, bonders, trackmen and laborers. Instruction was started at the top, working downward through the various grades to the men with picks and shovels.

A most successful school for track forces was conducted under the direction of the chief engineer during the winter of 1921-1922. Subjects were classified under the headings of bonding and joint welding, surface welding and grinding, special work drainage in open track, tie renewals and joint repair work, construction of city tracks, and reports. The classroom was equipped to accommodate about twenty-five students, with facili-



Vertical Rail Bender Used by the Eastern Massachusetts Street Railway



Testing Rail Joints with 36-In. Steel Straight Edge. The Card Indicates a Cup of 0.005 In.

TABLE I—MACHINERY UNITS AVAILABLE SEPT. 20, 1923, AND WORK COMPLETED DURING YEAR TO DATE

THE UPPER FIGURES SHOW THE WORK DONE DURING THE PREVIOUS WEEK AND THE LOWER FIGURES ARE FOR THE YEAR TO DATE

The enlargement of the track force in spring and summer is a feature of quantity production methods on the Eastern Massachusetts Street Railway

	Force	Jobs Working	Auth. Open and Working	Welders Working Seam	Welders Working Surface	Joints Welded Seam	Joints Welded Surface	Grinders Working U.	Grinders Working R.	Grinding Completed Joints	Grinding Completed Feet of Rail	Electric Tampers Working	Ties Tamped Hand	Ties Tamped Mach'y
Chelsea	64	5	1 working 3 open	2	1	29 1,231	54 1,341	1	0	112 2,267	0 12,847	0	0 472	0 10,057
Melrose-Woburn	79	4	2 working 4 open	1	2	12 389	59 2,480	2	1	54 2,462	144 17,458	0	147 2,843	0 459
Lynn	78	11	8 working 36 open	3	1	47 1,062	26 1,447	1	1	26 2,578	319 35,026	2	0 758	210 9,699
Salem	52	6	4 working 14 open	2	2	0 1,659	60 2,141	2	1	78 4,219	193 11,118	1	167 5,021	120 7,083
Lowell	98	4	7 working 13 open	2	3	38 3,003	93 3,438	2	0	93 3,607	0 5,270	2	29 2,883	212 12,735
Lawrence	48	5	3 working 4 open	1	1	16 1,104	4 1,000	1	1	12 1,489	525 20,375	1	30 2,440	240 4,690
Haverhill	14	2	1 working 4 open	1	1	0 329	11 813	1	0	11 971	0 0	0	8 6,152	0 1,750
Milton	2	1	0 working 0 open	0	0	0 0	0 0	0	0	0 0	0 0	0	0 1,070	0 0
Norwood	8	0	0 working 1 open	0	0	0 6	0 6	0	0	0 414	0 0	0	10 1,089	0 0
Hingham	0	0	0 working 0 open	0	0	0 0	0 0	0	0	0 0	0 0	0	0 399	0 1,206
Weymouth	20	2	1 working 2 open	1	0	8 43	0 116	0	0	0 18	0 0	0	28 748	0 330
Quincy	48	8	6 working 8 open	0	0	0 413	0 621	0	1	0 644	335 16,540	1	125 3,455	250 3,897
Brockton	137	9	6 working 16 open	4	3	60 413	120 6,294	3	1	121 6,645	510 13,357	3	130 7,418	151 8,294
Taunton	27	2	2 working 3 open	0	1	0 1,078	50 204	1	0	45 447	0 0	0	0 2,000	0 5,158
Fall River	107	5	5 working 18 open	2	2	31 1,272	51 1,874	2	1	85 2,461	280 12,827	1	275 10,279	300 11,805
Total	782	64	46 working 126 open	19	17	241 13,490	528 21,775	16	7	637 28,222	2,306 144,818	11	949 47,037	1,483 77,163

ties for showing lantern slides. The school was in session five days a week, beginning late in December and running to the latter part of February. Sessions lasted five hours each day, half of the time being assigned to illustrated lectures by the engineering staff or occasionally by manufacturers' representatives.

The afternoon sessions were devoted to the actual demonstration of track maintenance machinery, which was set up in the shop for instruction purposes. The shop contained sections of both sand-ballasted and rock-ballasted track so that seam welding, surface welding, grinding, tamping and other operations could be carried out on full-sized track sections. About 125 men went through the school. Classes were divided according to occupations, and attendance for not more than one day per week was required of any one individual. Many valuable suggestions bearing upon working methods in the field were received from those attending the school. The sessions were repeated during the winter of 1922-1923 and will be resumed again this year.

The railway has kept records of the amount of work of various kinds done for several years. The tremendous volume of such work may be judged from the fact that 137 miles of paved track or 47 per cent of the total paved track mileage have been welded. In unpaved territory 211 miles or 66 per cent of the total unpaved trackage have been welded. For the system as a whole 348 miles or 53.5 per cent of the total of 650 miles have been welded.

TABLE II—SUMMARY OF TRACK MAINTENANCE WORK DONE BY EASTERN MASSACHUSETTS STREET RAILWAY

	1921	1922	1923	Total
Joints welded	34,822	37,415	17,841	90,078
Surface welding	19,591	26,654	27,713	73,958
Joints ground	26,182	59,559	37,688	123,429
Linear feet of corrugated rail ground	.....	175,426	165,899	341,325
Ties tamped with electric tampers	.....	.....	92,000	92,000

	1920	1921	1922	1923	Total
Miles of track rebuilt	29.4	16.9	33.5	22.6	102.4
Miles of track overhauled	89.5	51.1	69.9	33.8	244.3
Ties installed	103,996	69,252	115,259	100,159	388,666
Pieces of special work installed	479	257	374	510	1,620

An analysis of the welded joint failures may be of interest. By the end of 1922 there were 77,128 seam-welded joints, of which, in the years 1921 and 1922, there were 265 broken joint plates or 0.34 per cent, 195 broken rails or 0.25 per cent and 120 broken welds or 0.15 per cent, a total of 580 failures or 0.74 per cent in the two years. By the end of 1923 there were 89,969 seam-welded joints, of which, in the years 1921, 1922 and 1923, there were 523 broken joint plates of 0.58 per cent, 320 broken rails or 0.35 per cent, and 131 broken welds or 0.15 per cent, a total of 974 failures or 1.08 per cent in the three years. For this work the organization of the engineering department has included a chief engineer, a return circuit engineer in charge of welding, bonding and machinery, three division engineers in charge of construction and maintenance, one assistant engineer and three men doing instrument work, two welding and grinding instructors, one chief clerk and one stenographer.

In spite of the vigorous attempts which have been made to accomplish a large volume of work, efforts have not been spared to produce at the same time a good quality of work. It has constantly been impressed upon the men by teaching in the school, by the criticism of the instructors that quality must not be sacrificed for quantity. It has been found on the whole that where men failed to produce quantity they usually failed also to produce quality. Where they work, however, they do good work. The workmen have been encouraged more than they have been criticised. It has

been the theory that the men want to do good work and failed in doing it only through lack of proper instruction on the part of their superior officers. This theory in the main has proved to be correct. In the few cases where men were found unwilling to work the company adopted the policy of quickly dispensing with their services.

When the very poor condition of the track existing in 1919 is considered, the tremendous volume of work done can be realized. As a result, riding has become more comfortable, noise has been eliminated, the expense of car maintenance has been reduced, as well as that of track maintenance, and derailments, particularly those due to the defective track, have become infrequent. This has not been accomplished without the expenditure of a great deal of effort on the part of the executives, but it is felt that the results have more than justified the efforts.

Welding Large Iron Castings with the Oxyacetylene Torch

The New York & Harlem Railroad Is Successfully Welding Conduit Yokes—The Castings Are Heated with Gas While They Are Being Welded and Afterward Cooled Slowly in Annealing Ovens—Cost of a Reclaimed Yoke One-sixth the Price of a New One

A DEPENDABLE autogenous weld on a large iron casting is extremely difficult to make, due to the fact that the metals in the casting adjacent to the weld are melted by the local heating. When this source of heat is removed, the molten iron solidifies quickly, owing to the large body of cold material in the casting around the portion melted. Naturally, that portion of the metal which has been liquefied and then cooled quickly is very hard, and uncombined carbon is brought to the surface. This carbon has a deteriorating effect on the weld, acting as a separator between the casting and the deposited metal. The volume of the metal at the weld decreases considerably as the weld cools, the linear contraction of cast iron while cooling from its melting point to ordinary room temperature being approximately 1 per cent. This means that each foot of length contracts approximately $\frac{1}{8}$ in. It is evident that severe stresses are set up by this contraction of the welded metal, and as a result either the casting soon breaks again or the weld is pulled apart.

A process to obviate this difficulty in the welding of cast iron has been developed by the New York & Harlem Railroad in connection with the reclamation of the large yokes which are used in the underground conduit construction in New York City. These frequently break after a number of years of service, and in the past have been thrown away and replaced. The development of the welding process has made it possible to reclaim practically all of them and restore them for further use. The description of the method of reclamation indicates how this has been accomplished.

Clamps Hold Yokes in Position

As these castings are very large, weighing from 500 to 525 lb., it has been found desirable to provide for economical handling during their removal from the street and while being worked on in the shop. Accordingly, a variety of clamps has been prepared, the proper ones being placed on a broken casting before it is removed from its position in the street. This clamps the broken parts securely together. A top plate with a U-shaped projection is bolted to the top of the yoke, so that a chain and tackle can be hooked in for handling. An accompanying illustration shows one of these large yokes with a clamp attached to hold the broken parts together, and also the plate with a chain attached for lifting. A number of other clamps which are used in this work are also shown in the illustration. After the broken yokes have been clamped together, they are transported on cars or trucks to the shop where the welding work is done. Clamping the various parts together before they are removed from the street reduces the labor in handling, and there is no danger of any part becoming lost. Where castings have several breaks in half the yoke, it is cut in two by the carbon arc and the good half is then welded to another similar good half from another yoke.

Preheating and Annealing Are Essentials of the Method

In order to make a successful repair on a cast-iron piece of such large section, the company has found it necessary to provide for heating the casting preparatory to the welding operation, and to arrange for slow cooling so as to anneal the entire casting. To facilitate handling and prevent cooling of the metal between the welding process and the annealing a welding room has been provided immediately in front of the annealing ovens with three sides inclosed. The welding stand is constructed of 1-in. pipe, with its top about 30 in. from the floor. This stand is provided with three special gas burners. Each burner has a 1-in. supply pipe, bent to a circular form, to which short uprights of $\frac{3}{4}$-in. pipe are welded. Each of these upright pipes is beveled slightly, and has small holes in the top to permit the correct amount of gas to flow. When the yoke is in position one of the three burners is underneath the center and one under each end. With this arrangement the yoke can be heated by the gas flame, no matter where the breaks may be, and without the necessity of changing the position of the yoke on the welding stand after it has once been placed. One of the illustrations shows a yoke in position on the stand with the operator cutting out a V-shaped groove in the break preparatory to welding.

Oxyacetylene is used for cutting and is also used for the entire welding process. Provision, however, is made for electric welding and also for cutting by the carbon arc if desired.

In carrying on the work the burners underneath the yoke usually are lighted at the time that the cutting

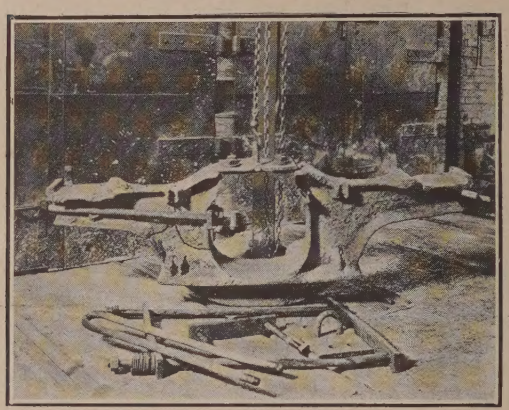
commences, and by the time that the cutting and welding are finished the yokes are heated. The flame can then be reduced to a size just sufficient to keep the casting hot, should the welding extend over a considerable period.

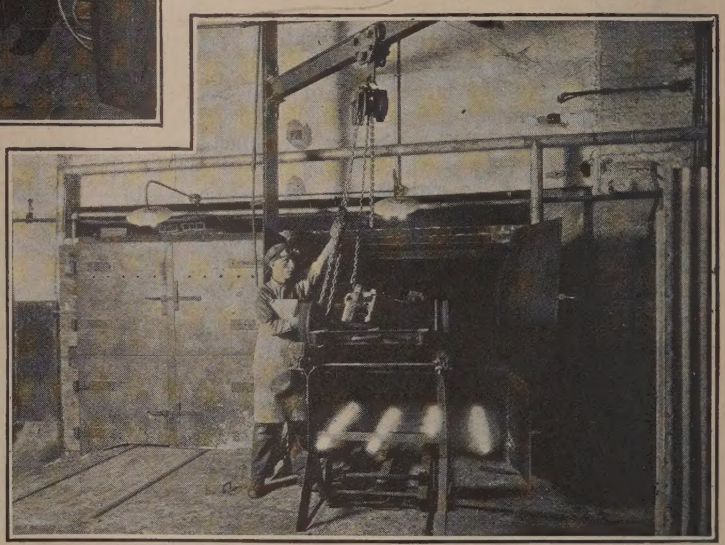
Two ovens of brick have been constructed, each of which is 6 ft. 3 in. wide, 10 ft. 4 in. long and 6 ft. high, providing sufficient room for four yokes. Four gas burners are provided at the bottom of each oven. These burners consist of 1-in. pipe running the length of the oven and perforated with small holes to permit the flow of gas. The same blower that serves the welding stand also supplies air for the burners in the ovens, and galvanized-iron pipes conduct it to the regulating valve. Two sheet-iron doors are provided for each oven. Each door has five 1-in. holes as a safety precaution in case the gas pressure should be reduced so that the flame would go out.

The burners in the oven are lighted a sufficient time in advance so that the oven is hot when the castings are ready to be inserted. After castings are placed in the oven the gas is turned off and the oven is then allowed to cool slowly. The oven will stay hot for approximately sixteen hours. In practice, however, castings are cooled in a minimum of six hours.

A jib crane has been installed in front of the cooling oven to facilitate handling. This serves the welding stand and the oven, and it also is used to unload or load the yokes on or off the cars and trucks, which can be run alongside. The yokes are handled by the jib crane from the cars to a storage space provided at the side of the oven front platform. From there they are picked up and placed in position on the welding stand by the crane as required. The upright column for the crane is made of old T-rail with an I-beam for a jib. On this jib a 1-ton Yale block travels. The upright is trussed with a tension member at the back. An accompanying illustration shows this jib crane.

Each oven has two tracks, one above the other, so that the castings can be loaded on a small car and rolled into and out of the ovens. The bottom track extends outside on a platform in front of the ovens. Extensions are provided for the upper tracks by a movable framework and rails. An I-beam extends across the center of the oven, providing support for one end of each of the rail extensions, while an angle-iron stand is provided to support the other ends. Two short lengths of rails are used, dowels being provided so that the rails are placed in exact position and are firmly held when once installed. With the extensions in place the car can be rolled outside so that castings can be handled onto or off the car directly by the use of the jib crane.





Top, left, cutting out grooves in a yoke preparatory to welding, with yoke in position on welding stand.

Below, at left, broken yoke held together by clamps. Other clamps used are shown in the foreground.

Below, right, placing a yoke on a car for insertion in the cooling oven.

Air pressure for the burners of the welding stand and also for the burners in the oven is provided by means of a blower installed on a platform attached to the wall above. Air is conveyed from the blower to the burners by 4-in. galvanized pipes. The admission of gas and of air from the blower is regulated by valves placed at the welding stand, convenient to the operator. The switches, fuses and starting box for the blower motor are installed on the wall adjacent to the welding stand.

Since this welding equipment has been installed the average cost for welding a yoke has been $6.25, and this is less than one-sixth the cost of a new yoke.

Public Service Testing Buses

Detailed Specifications Have Been Adopted for Trial Runs by Fifteen Different Types of Buses

AS A PRELIMINARY to determine the extent to which it will engage in the bus business as supplementary to its electric railway service and the type of buses to use, the Public Service Railway of New Jersey is conducting an extensive system of tests on buses. Fifteen buses have been selected for these tests, some of which have been completed. The list of buses and scheduled dates for the tests follow:

Chicago single-deck (Yellow Coach)	Jan. 14
Chicago double-deck (Yellow Coach)	Jan. 16
Fifth Avenue single-deck	Jan. 18
Fifth Avenue double-deck	Jan. 21
International Harvester	Jan. 22
Fageol (street car type)	Jan. 25
Reo	Jan. 28
Garford	Feb. 1
Federal	Feb. 4
Philadelphia double-deck, Mitten-Traylor	Feb. 6
White	Feb. 10
Mason (Durant)	Feb. 13
Pierce-Arrow	Feb. 15
Day Elder	Feb. 18
Mack	Feb. 20

In addition to the performance tests outlined below, some of these buses are being tried out in regular passenger service at Plainfield and Camden. Those at Plainfield are two Fageol, three Fifth Avenue type J and four Reo type F. Those at Camden are twenty-one White, models 50 and 50A.

The performance tests are being conducted over a test loop, 11.2 miles in length, in Newark, Orange, West Orange and East Orange, combining opportunities for level running and hill climbing. The paving includes rough cobble, smooth cobble, brick and asphalt. In addition, a short straight level section of road with asphalt paving in Newark will be used to determine the maximum rate of acceleration for each bus. An outline of the specifications for the performance tests, which are being conducted under the name of the Public Service Transportation Company, follows:

Outline of Performance Tests of Motor Buses

Object. The object of the tests is to determine (1) the ability of each make or type of motor bus to perform under a wide range of both normal and maximum service conditions; (2) the relative abilities of motor buses in a given service; and (3) the character of work for which each make or type of motor bus is best suited.

Conditions. Agents will be requested to submit for test, upon a prearranged schedule, one or more gasoline motor driven buses of the so-called street car type provided with one front or rear entrance-exit door and cross and longitudinal seats carrying from 17 to 67 seated passengers. The equipment submitted shall be standard in all respects, fitted with stock parts, and motored and geared as best suits the agents.

Agents are requested to participate in the tests of their own buses and to offer such suggestions as to the conduct of tests as will assist in developing and demonstrating the performance and characteristics of buses; but such changes in or additions to the tests specified herein as may be adopted shall apply equally to the tests of all buses submitted. Agents will not be permitted to participate in the tests of competitive buses, nor will they have access to the results thereof.

Each agent is requested to familiarize himself with the tests and routes outlined herein and to have his equipment in the best possible normal operating condition prior to the tests. Ample opportunity will be given for this purpose. No changes or adjustments of equipment will be permitted during the series of four tests outlined herein. Changes made necessary by the failure or abnormal performance of equipment may be considered cause for the running of a new series of tests.

All tests of an individual bus will be made during one week day, between the hours of 8 a.m. and 6 p.m., if possible. Decision to start or stop buses shall rest with representatives of the Transportation Company.

Agents shall furnish signed statements giving information relative to each bus prior to the tests, as follows:

(1) Diagram showing engine torque and horsepower curves, (2) cylinder bore and stroke, (3) cylinder volume, (4) normal revolutions, (5) maximum safe revolutions per minute, (6) transmission gear ratios, (7) differential or rear axle gear ratios.

Agents shall equip each bus submitted for test with a calibrated and certified speedometer. This may be installed either temporarily or permanently.

Agents shall make provision for the insertion of a thermocouple in the top radiator connection to the engine by drilling a $\frac{7}{8}$ in. hole in the top radiator connection below the minimum water level and tapping with a $\frac{3}{4}$ in. S.A.E. thread. The hole so made shall be closed with a screw plug, pending the insertion of the thermocouple by representatives of the Transportation Company.

Agents shall provide means for easily and rapidly draining the main gasoline storage tank, vacuum tank and all connecting piping up to the carburetor.

1. Schedule and Economy Test

Each bus submitted for test will be operated for at least four trips over an established test loop about 11 miles in length, upon which will be found nearly all conditions of traffic, grades, street surfaces and other elements common to city and suburban bus operation. Description of the route and map is attached.

Stops will be made at established points averaging about eight per mile, and the time of each stop will be 7 seconds unless traffic conditions require other periods.

Time will be recorded at each start and stop, that is, at the beginning and end of each of the eight individual runs per mile.

Speed will be recorded and will be limited to a maximum of 30 miles per hour.

Gears used during each run will be recorded.

Temperature of the engine cooling water will be recorded during the progress of the test.

Weight of the bus and its load will be measured during the progress of the test. The passenger load, including observers, but excluding driver, will be about 60 per cent of the normal rated seating capacity. Other loads may be used on later tests.

Tire pressures will be measured at the beginning and end of the test and adjusted to the tire manufacturer's recommended values for the sizes of tire used and the weights carried.

Gasoline consumption will be measured. The fuel system will be drained at the beginning of the test and a measured quantity of "Standard" gas, of known gravity, will be supplied by the Transportation Company at the expense of the agent. The quantity remaining at the end of the test will be measured.

Riding quality, vibration, side sway and other elements affecting the comfort of passengers and driver will be observed and recorded.

Weather conditions and condition of pavements will be recorded.

Traffic conditions will be recorded.

Driver shall be furnished by the agent for two of the four trips, while one competent driver in the employ of the Transportation Company will operate each bus for the two remaining trips.

Observers will be furnished by the Transportation Company. Each observer will perform the same duty during the tests of all buses, in order that errors due to the human element may be kept as constant as possible.

2. Hill Climbing Test

Each bus submitted for test will be operated in a hill climbing test two or more times up and down Mt. Pleasant Avenue, West Orange, for a distance of about 6,000 ft. on a grade averaging 7.35 per cent and having a maximum of 11.02 per cent. Two groups of tests will be made: A. From dead stop at beginning of the grade. B. With 25 miles per hour running start at the beginning of the grade.

Time will be recorded at the beginning and end of each run and at such intermediate points as may be determined by gear shifts.

Speed will be recorded at established points along the grade and at points where gear shifts are made, using the same devices as in the schedule tests.

Gears used during each run will be recorded.

Brakes, both service and emergency, will be tested singly on the runs down grade to determine their ability to hold the loaded bus.

Temperature of the cooling water will be recorded during the progress of the test, using the same devices as in the schedule tests.

Weight of the bus and its load will be practically the same as in the schedule tests. Maximum loads may be used on later tests.

Tire pressures will be the same as in the schedule tests.

Gasoline consumption will not be measured, but gasoline of the same kind and quality as used in the schedule tests will be used and the carburetor will have the same setting as in the schedule test.

Weather, pavement and traffic conditions will be recorded.

Driver shall be furnished by the agent.

Observers will be furnished by the Transportation Company.

3. Acceleration Test

Each bus submitted for test will be operated in an acceleration test over a section of Lake Street, Newark, adjacent to Branch Brook Park and north of Bloomfield Avenue. This section is straight and level, is unimpeded by traffic and has a smooth asphalt surface. Each bus will be operated from a dead stop to free running speed in the shortest possible time consistent with good operation. Several runs will be made to secure a fair average.

Time will be recorded at the beginning and end of each run and at intermediate points.

Speed will be recorded at established points on the run and where gear shifts are made, using the same devices as in the schedule tests.

Weight of the bus and its load will be practically the same as in the schedule tests. Maximum and light loads may be used on later tests.

Gasoline consumption will not be measured, but gasoline of the same kind and quality as used in the schedule test will be used and the carburetor shall have the same setting as in the schedule tests.

Driver shall be furnished by the agent.

Observers will be furnished by the Transportation Company.

4. Braking Test

Each bus submitted for test will be operated in a braking test over the Lake Street course used for acceleration tests. Each bus will be braked from a previously sustained speed of 25 miles per hour to dead stop, using the service brake and the emergency brake independently, in the shortest possible time without slipping the wheels. Several runs will be made to secure fair averages.

Time will be recorded at the beginning and end of each run.

Speed will be recorded at the beginning of each run and at intermediate points.

Weight of the bus and its load will be practically the same as in the schedule tests. Maximum and light loads may be used on later tests.

Tire pressures will be the same as in the schedule test.

Drivers shall be furnished by the agent and by the Transportation Company and they shall be used in turn.

Observers will be furnished by the Transportation Company.

Large Shop for Brooklyn

PLANS are being prepared for large repair shops for the Brooklyn-Manhattan Transit Company. They will be located between the Sea Beach right of way on the west, Shell Road on the east, Avenue X on the north and Coney Island Creek on the south. This tract comprises about 60 acres. It is said that the total investment in these shops when completed will be about $10,000,000 and that they will be the largest electric railway shops in the country.

Boston Elevated Occupies New Shops

DURING January the Boston Elevated Railway paint department was moved to the new paint shop, forming part of the new elevated shops in course of erection near the Everett terminal, and during February it is expected that the new woodworking shop in the same shops will be completed and its machinery installed. As yet the company has not begun construction on the buildings to house its machine shop, equipment shop, wheel and axle shop and blacksmith shop. In other words, about half of the shops, shown in plan on page 240 of the ELECTRIC RAILWAY JOURNAL for Feb. 10, 1923, or that portion to the south, has been completed. The portion to the north still remains to be done.

The present extensions to the company's repair facilities obtained through the erection of these shops will be a great help in the maintenance of equipment. It will enable the company to shut down its Bartlett Street shops. The Albany Street shops will necessarily be kept in service until the completion at Everett of the machine shop. Below will be found a list of the new tools ordered for the paint shop, brass shop and mill at Everett. Most of these tools are now in position.

LIST OF NEW AND REMODELED TOOLS AT EVERETT SHOPS

Mill

New Tools

Kind	Size	Make
Molder	No. 600	Fay & Egan
Sander, 42 in.	No. 393	Fay & Egan
Double surfacer	No. 140-A	Fay & Egan
Ripping and jointing machine	No. 386	Fay & Egan
Hand planer and jointer	No. 506	Fay & Egan
Band saw	No. 50	Fay & Egan
Double-head sash and door tenoner	No. 505	Fay & Egan
Hollow chisel mortiser	No. 510-A	Fay & Egan
Double spindle shaper, type F	No. 452	Fay & Egan
Doweling and rod machine	No. 7	Fay & Egan
Corner and rounding machine	No. 294	Fay & Egan
Band saw filing and setting machine	No. 3	Fay & Egan
Circular saw filing machine	No. 5	Fay & Egan
Patternmaker's lathe	No. 411	Fay & Egan
Double-disk sander	No. 466	Fay & Egan
Cabinet surfacer	No. 156	Fay & Egan
Knife grinder	No. 101	.....
Heavy bevel and miter saw	No. 22	Pettingill
Single spindle borer	No. 356	Greenlee
Railway cutoff saw	No. 6	American
Universal saw bench	No. 30	American
Hand block sander	No. 16	American
Grindstone	36 in.	American

Old tools equipped with new individual motor drive

Buzz planer	16 in.	Rogers American
Inside molder	13 in.	Rogers
Large mortiser	Car mortiser	Greenlee
Small tenoner	No. 2	Houston
Band saw, 2 in.	42 in.	Fay
One universal boring machine	No. 8	Fairhaven
One arbor saw	Tilting arbor	American
Circular saw	.....	Fairbanks

Brass Worker's Tools

Belt polisher	.....	Blount
Double emery wheel	12 in. x 2 in.	U. S. Elec. Tool Co.
Two buffing wheels	12 x 1½ in.	U. S. Elec. Tool Co.

Sheet Metal Tools

Circular shears	No. 208	Niagara
Squaring shears	No. 8 96 in. ⅜ in. metal	Niagara
One power punch	No. 36	Niagara
Hand brake	8 ft.	Dreis & Krump Mfg. Co.
Hand brake	4 ft.	Dreis & Krump Mfg. Co.
Hand shears	No. 14	Niagara
Hand punch	No. 14	Niagara
Bar folder	36 in.	Peck Stow & Wilcox
Nazel hammer	No. 2	Nazel Eng. Works

Paint Mixing Machinery

Three heavy duty mixers	200 gal.	J. H. Day Co.
White lead mixer	50 gal.	J. H. Day Co.
Three change can mixers	50 gal.	J. H. Day Co.
Ten enamel paint mixers	10 gal.	J. H. Day Co.
Three stone color grinders	15 in.	J. H. Day Co.
One pebble mixer and grinder	No. 7 Abbe	J. H. Day Co.
One putty mixer	48 in.	J. H. Day Co.

Ovens

Electric oven	6 ft. x 6 ft. 4 in. x 3 ft. deep	Oven Equip. & Eng. Co.
Electric oven	7 ft. 6 in. x 6 ft. 9 in. x 6 ft. deep	Oven Equip. & Eng. Co.
Electric oven	3 ft. 6 in. x 5 ft. 6 in. x 3 ft. 6 in. deep	Oven Equip. & Eng. Co.

New Features of St. Louis Automatics

Five Substations Installed by United Railways Have Forced Ventilation and Duplicate Power Lines—Units Chosen for Full Load Operation with Provision for Exchanging Equipment to Obtain Future Increased Capacity

SUCCESSFUL operation of the fifth automatic substation installed during the past year marks the completion of the present program of the United Railways of St. Louis for the application of this type of station to its power system. Careful study of the requirements for applying automatics to the network on a heavy city distribution system have resulted in a number of interesting features which have been incorporated in the new stations and which were developed to insure maximum capacity and reliability.

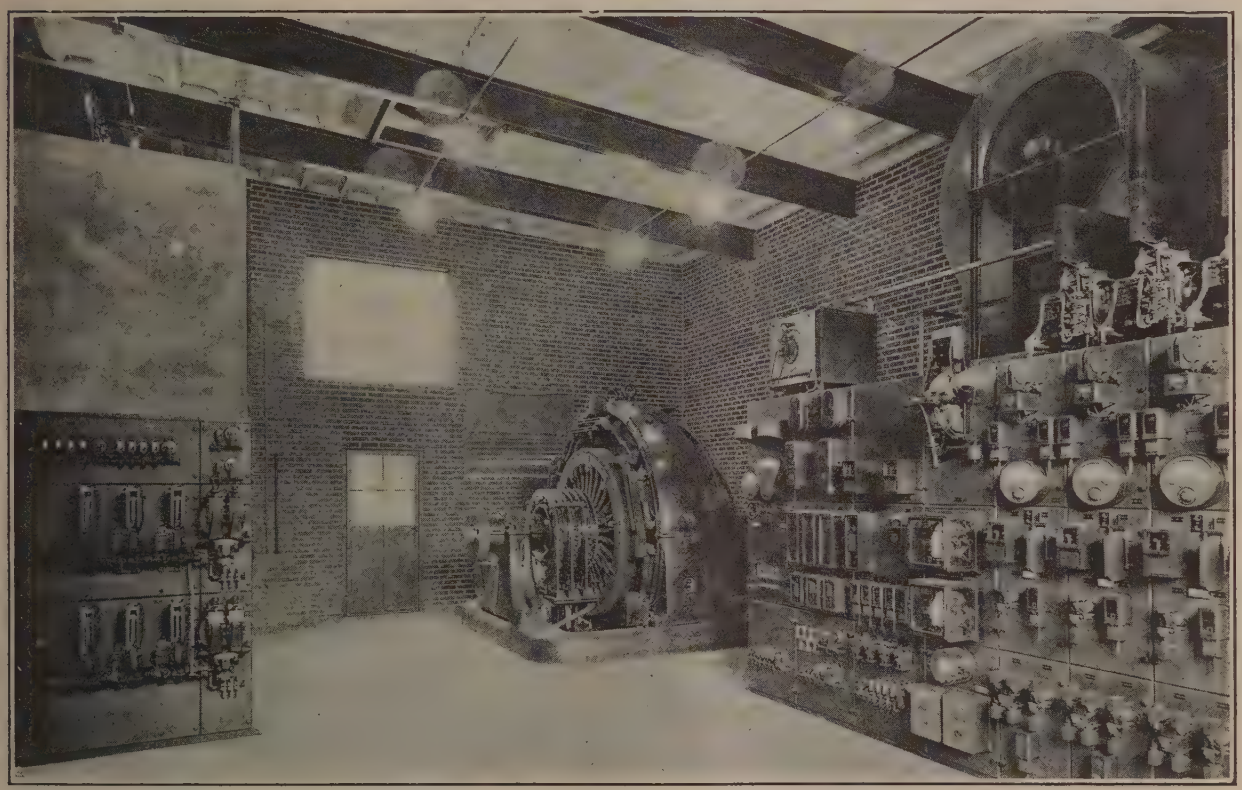
These features comprise a number of departures from established automatic substation practice. Natural ventilation was found inadequate during the hottest period of the year, so that forced ventilation is used at such times to obtain the full rating of the machines. The duplicate power lines have an automatic switching arrangement so that in case of failure of one the other will take its place without delay. The stations are designed as complete units, with no space for additional machinery, but with provision for replacing the converters and transformers with others of larger size in case increased capacity becomes necessary.

These stations were designed by the railway company's engineers under the direct supervision of W. E. Bryan, superintendent of power. The work of construction and equipment was carried out completely by the railway, utilizing General Electric Company apparatus.

Two automatic substations, each of 300-kw. rating, have been in service on some of the outlying lines of this property since the early part of 1921, and experience with these stations showed them to be satisfactory for this class of work. Increased car service within the city during recent years resulted in overloading some of the existing manual stations and made necessary an addition to the capacity of the d.c. system.

Some of these manual stations were large enough to allow the installation of additional converter capacity, and previous practice would have dictated such installations. The advent of the automatic station, however, made it possible to effect a material reduction in distribution copper and distribution losses by applying these units as nearly as possible at the points of maximum power requirement. As a result, it has not only been possible to locate the new substations so that the trolley voltage regulation has been materially improved, but at the same time it is estimated that the use of the new stations will allow the removal of approximately 125,000 lb. of copper now in the distribution system.

Two of the five stations put into service since



The Franklin Avenue Substation Has a 2,000-Kw. Unit. A Portion of the 2,000-Amp. Multiple D.C. Reclosing Feeders Are Shown Above the Switchboard to the Right

A Simple Building Is Used Where the Surroundings Permit

January, 1921, are single units of 1,000 kw. capacity, each, with oil-cooled transformers. These stations are Maple and Arsenal and their equipment is entirely new.

Clark and Franklin stations have each a single 2,000-kw. unit. The rotary and transformer equipment was used for about nine years in manual stations, but was suitable for use with the automatic apparatus which was purchased. In these two stations the transformers, of the forced air-cooled type, are mounted in a separate transformer room. In the other three stations the oil-cooled transformers are mounted in the same room with the other apparatus.

Each station as installed is loaded to its full rating with the existing load. No space is allowed in the buildings for additional units, but the design is such that the present machines can be replaced with the next larger commercial size to take care of future requirements. Such a change requires only the replacement of the rotary and the transformer. The buildings are made small and compact, but the arrangement is such as to allow for changes of this kind.

Under the plan adopted, the existing stations can be expanded in gradual steps so that they are always loaded up to capacity. A considerable saving is made in the cost of buildings over the practice of making the structure large enough to take one or more additional machines. Furthermore, it was considered that the addition of a second machine to an existing station would mean an increase in capacity of 100 per cent, which probably would be in excess of the requirements for some time after the addition was made.

In manually controlled stations the problem of ventilation is not serious. The stations are usually made of liberal size and plenty of door and window space can be allowed because of the presence of attendants. These conditions do not hold with automatics. It was considered desirable to make the buildings as compact as possible and to keep them closed, particularly as some of them were located in congested districts where minimum size and maximum security were important.

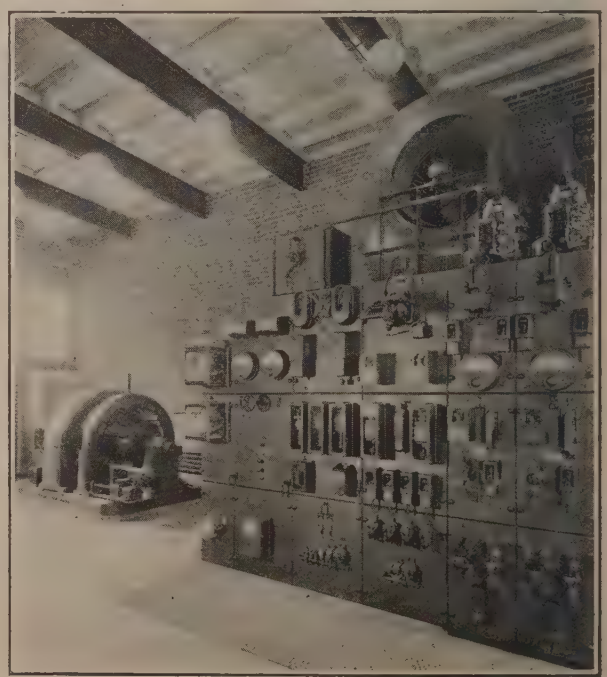
Natural ventilation, depending upon louvers in the side walls and some form of roof ventilator to maintain a circulation of air through the station, was not considered entirely satisfactory. With natural ventilation, the amount of air circulated varies with the temperature of the air and the direction and velocity of the wind. It was found that the full rated capacity of the station could not be obtained in hot weather because of inadequate ventilation. A forced draft ventilation system was designed by the railway to remove this limitation. It consists primarily of a fan mounted on a concrete balcony above and behind the switchboard and arranged so as to draw air out of the station and exhaust it at a point near the roof. The fan used is the Buffalo Forge Company "Turbo-Conoidal" type No. 7½, with a capacity of 11,500 cu.ft. per minute. It is driven by a 5-hp. motor. The fan is automatically started and stopped by thermostats on the converter and on the station resistance grids.

Although the stations are provided with a number of wall louvers near the floor line, all but two of these are closed when the fan is operated, which is necessary only in hot weather, as the natural ventilators take care of the requirements at other times. When forced ventilation is being used, the incoming air is drawn directly around the rotary converter and transformer and is blown through the series resistance grids before being exhausted.

A sheet metal duct is installed at one of the wall louvers and leads the incoming air down to a duct in the concrete foundation under the converter, from which it passes directly up through the machine. A second and similar duct leads the air coming in through the second wall louver to a passage in the foundation under the oil transformer and it then passes up through openings around the base so as to create a draft of cool air on all sides. In those stations where forced air-cooled transformers are used, they are provided with a separate blower independent of the ventilation system.

Variable conditions surrounding the different stations affect the height of the louvers in the wall. It is the practice to set these as close to the floor line as possible, but where the location of the station exposes it to considerable dust, the louvers are raised 4 or 5 ft. above the floor line so as to keep the dust from entering the station.

The resistance grids are inclosed in a housing made



A Single 1,000-Kw. Unit Is Installed in the Arsenal Street Station. The Ventilating Blower Is Mounted Above and Behind the Switchboard

of 1-in. transite board mounted on a steel frame. This housing is directly connected to the discharge side of the station fan. The entire front of the resistance housing is made up of a series of swinging shutters, so that it can be opened to the rest of the station when the fan is not operated and the ventilation is by natural means.

The system is designed so that the station can, if necessary, be operated at 50 per cent overload with a rise in the temperature of the air of not more than 25 deg. F. A comparison of costs shows that the total cost of the fan and motor is about equal to the cost of the additional roof ventilators that would have had to be installed for natural ventilation.

Substantial construction consistent with minimum cost was the object of the building design. In each case the structure has been made to fit into its surroundings. Where the station is located so as to face the street in either a residential or business neighborhood, terra cotta trim is applied to improve the appearance. Some of the stations are located on alleys in congested districts, and under these conditions the entire structure is made of common brick. One station of this type is shown in an accompanying illustration.

Clark, Franklin and Evans stations are located in heavy traffic districts, where uninterrupted operation is of paramount importance. By utilizing existing high-tension power lines, these stations are arranged so that each has two incoming 13,200-volt, three-phase, 25-cycle supply cables, practically all power being purchased. Each of these cables is of sufficient capacity to carry the entire station load.

Maple and Arsenal stations are less vital to the maintenance of continuous service, and they are, therefore, equipped with only one incoming line to the automatic apparatus. In the case of Maple station, however, a second incoming cable is available and the station can be thrown over to it by the operation of a manual switch.

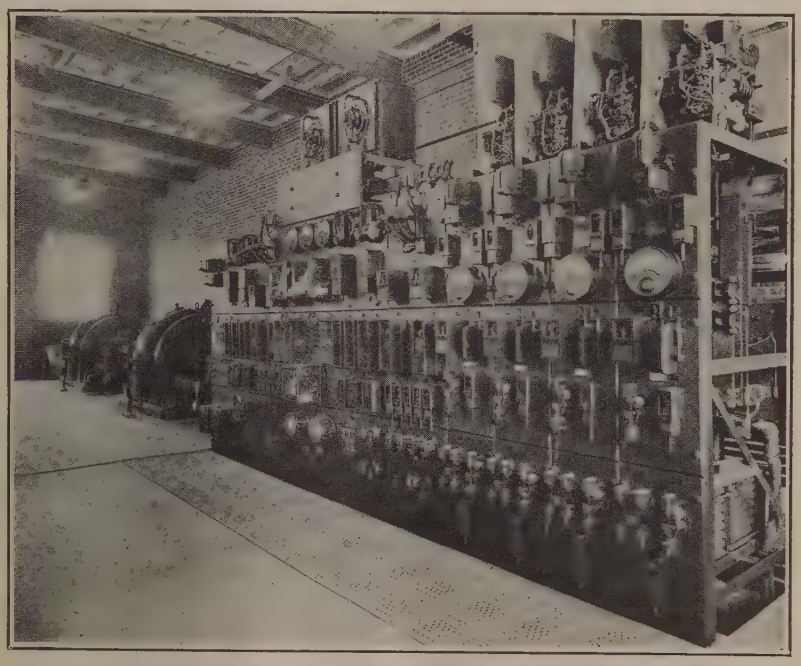
Automatic switching between the two incoming cables is provided in Clark, Franklin and Evans stations. One of the lines is designated as the "preferred" line and under normal conditions carries the entire load at all times when the station is in operation. If the preferred line fails for any reason, the second line is immediately and automatically substituted. This is accomplished through the tripping relay, which when tripped completes the circuit, causing the second line to pick up the load. When the trouble on the preferred line is removed and the repair man closes the disconnects out on the line the load immediately shifts back to the preferred cable.

Evans station is a two-unit installation. Each of the 1,000-kw. rotaries is provided with its own oil-cooled transformer, and the station is also one of the three having duplicate power lines. In this case the load of both machines is carried on one of the lines, and in case of trouble the second is switched in automatically as in the case of the single-unit stations.

Either machine may be made the first to pick up the load by throwing a manual switch in the station. The two machines operate in parallel when both are on the line, but only one is required to carry the load except in the peak period. When it is needed, the second machine is brought on automatically, and it also shuts down automatically when the load drops to the capacity of the first rotary. If No. 1 machine is set to pick up the load first when the station goes into service, and for any reason it fails to do so, No. 2 machine will automatically take its place.

In this station a single exhaust fan provides the ventilation for both sets of rotaries and transformers. The ducts in the concrete below the rotaries are divided so as to insure equal distribution of air to both machines and also to avoid diverting the air through one of them, if it is not running.

All the stations are completely equipped with high-speed circuit breakers on outgoing feeders. These are provided with automatic "feel out" reclosing apparatus arranged to test the circuit at predetermined intervals through an auxiliary contactor and current-limiting resistance. An adjustment on these breakers, which was made by the railway's engineers, allows the first test contact to be made after a very short interval. This contact is then repeated periodically at any predetermined time setting.



The Evans Avenue Substation Has Two 1,000-Kw. Units. The Two Converters and Complete Switchboard are Shown with Reclosing Breakers Above

The high-speed breakers are designed to differentiate between a legitimate load and one caused by a defect on the circuit. An inductive shunt on the breaker allows it to carry a 4,000 or 5,000-amp. normal load, but to trip out on less than 2,000 amp. in the event of a ground or short.

In Clark and Franklin stations, which are located in the downtown heavy traffic section of the city, the rotary converters are shunt wound. In this district the feeder network between the automatics and the adjacent manual stations is of very low resistance. The object of the shunt winding on the rotaries of the automatic stations is to prevent them from taking more than their proper share of the load, without at the

same time causing objectionable fluctuations in voltage. This would occur if the load-limiting resistance of the automatic station cut in, because this resistance is a large proportion of the entire feeder resistance in this section.

The shunt winding drops the voltage of the automatic station gradually as the load increases, and thus prevents it from carrying an excessive proportion. Cars operating in this section move slowly, either on resistance notches or with motors in series a large portion of the time, so the reduced trolley voltage due to shunt winding of the rotaries is not considered objectionable. In the outlying sections the feeder resistance is relatively higher and compound-wound rotaries are used. The load regulation is handled by the station series resistance, as under these conditions cutting in of the resistance does not produce as great a voltage fluctuation as would occur in the congested district.

As is customary, thermostats on the load-carrying apparatus are arranged to shut down the station if the temperature becomes excessive on any part. The bearings are similarly protected.

On the air-cooled transformers the blower motor is tied directly to the low-tension side of the transformer. A speed-regulating switch on the blower end will trip out the station if the fan is not up to speed for any reason. When the station shuts down due to a defect in its apparatus, a telltale signal is illuminated in an adjacent manually operated substation so that the load dispatcher can be immediately notified.

Brooklyn's "Duplex Car" Placed in Service

A Two-Unit, Three-Truck Car, 63 Ft. 10 In. Over All, Has Novel Center Construction with Weather Tight Drum to Permit Free Passage Between the Two Sections

The New "Duplex Car" with Three Trucks Constructed by the Brooklyn-Manhattan Transit Corporation

A NEW type of duplex car with three trucks was placed in service by the Brooklyn-Manhattan Transit Corporation Feb. 6 on its DeKalb Avenue surface line in Brooklyn, N. Y. This car is built in two units and has an over-all length of 63 ft. 10 in. with seats for seventy-one passengers. The standing room provided will accommodate approximately 100 additional during rush hours. The weight of the experimental car as constructed is about 36 tons, but this weight can be reduced somewhat when parts are designed for quantity production.

In building this duplex car the company used two of its 4,500 type cars, which as orginally constructed were 42 ft. 6 in. long over all. These cars were cut off at one end just outside of the bolster, which was then used as a support for the new swivel castings. The truck used for supporting the center portions of the two units is a Brill type 62 EF, such as that used by the company under its center-entrance trail cars. This truck has a wheelbase of 4 ft. 4 in., with 22-in. diameter wheels. The truck was used without changes except those necessary to provide for attaching the truck swivel casting and side bearing plates for the body.

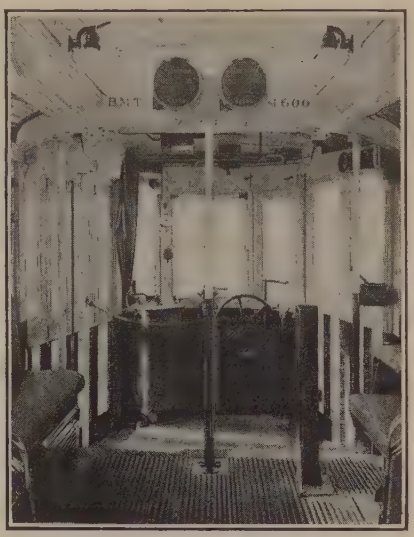
The construction of the center section of the duplex car is of particular interest. A drum type vestibule connects the two sections, being carried directly on the center truck by strap connections to the truck bolster. This drum is 4 ft. in diameter. Two circular sections of $\frac{3}{16}$-in. steel inclose the two opposite quadrants, being supported by a $\frac{1}{4}$-in. bottom plate, the open quadrants forming the passageway through the center section. The inside of the drum is lined with a fibrous material and rubber matting covers the floor. This connecting vestibule between the two units is used by standing passengers during peak-load periods. There is sufficient space inside the drum for eight standees. Two grab handles extend around the circumference on either side. These are located at a height of about 43 in. above the floor level.

The center ends of the two-car units are shaped so as to come into relatively close contact with the center drum, and as they rotate about a common center only a small clearance is needed. Rubber rollers mounted on the bodies provide for a weathertight connection between the car ends and the drum. Each roller is supported at the top and bottom by bearings in a plunger with springs to press it firmly against the surface of the drum.

The top of the center vestibule drum extends only to the bottom of the clerestories of the two units. In order to keep water from dripping down inside, and to secure satisfactory drainage, the top of the drum is provided with three angles bent to circular arcs at the edges adjacent to the car ends. The top of the drum

Conspicuous Signs Give Passengers Necessary Information as the Car Approaches

Unrestricted Passage Between the Two Units Is Provided by the Center Vestibule Drum

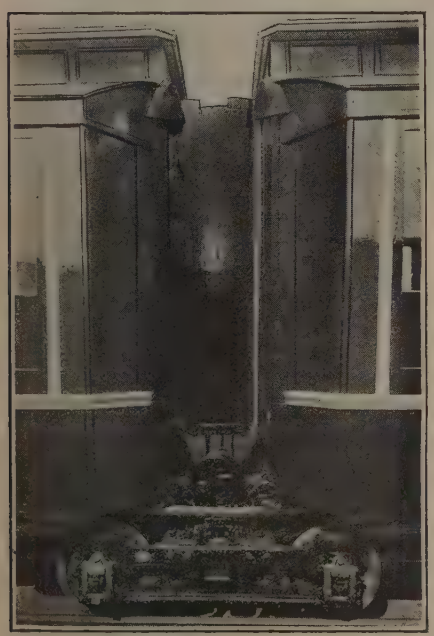


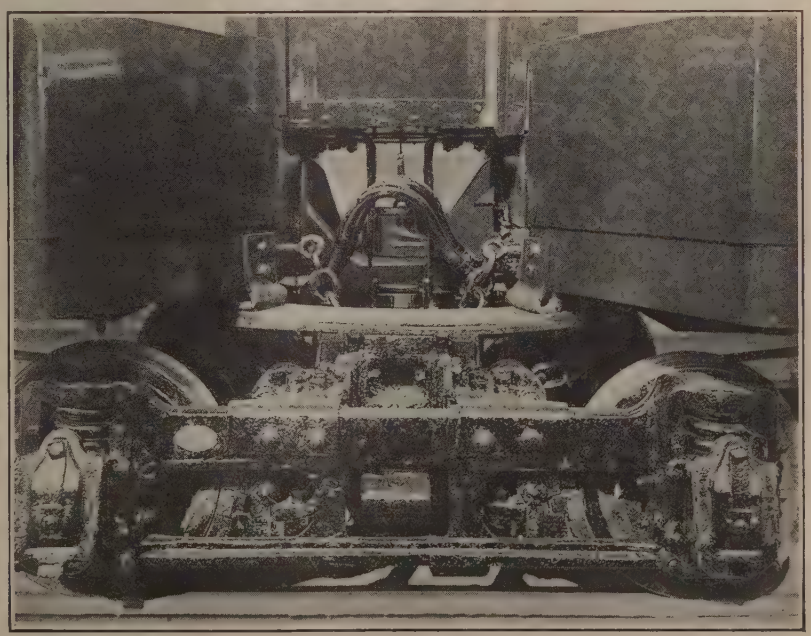
Porcelain Enameled Bars and Stanchions Provide Substantial and Sanitary Supports for Standing

is also shaped so that the lowest portions are at the sides, and the top of the drum adjacent to the two units passes underneath the clerestory. Thus any drippings from this will fall inside the angles. If any water should splash over the top of the first angle, the other ones are provided as a barrier to conduct the water to the edges for draining.

The construction of the underframing and swiveling castings at the inside ends of the two units is of particular interest. Three swiveling castings are provided. The upper and center ones are attached to the underframes of the two bodies, while the bottom casting is attached to the truck bolster. The king pin fastens through these three castings and through the truck bolster bearing, as shown in an accompanying drawing. Channels of 4-in. section are used for the outside members and the diagonal braces, and two 6-in. channels run directly from the swiveling casting to the cross-members of the underframe. The construction is substantial, the entire weight of the inside end of each unit being borne by its swivel casting and transmitted through the spherical bearings to the truck bolster. Circular side bearings are provided, but these serve only to prevent excessive side motion and do not support the weight of the body. Circular steel plates on the trucks attached to the center bolster and similar plates riveted to the ends of the car bodies form these side bearings.

The air and electrical flexible connections between the two units are carried over the top of the center truck. The air hose passes on one side and the electrical connections on the opposite side of the swivel joint. In order to provide for taking the two units apart, as may be necesssary for maintenance repairs, a special type of junction box is provided for the electric wires. It consists of two facing terminal boards, the leads from the car body ending in a set of socket terminals



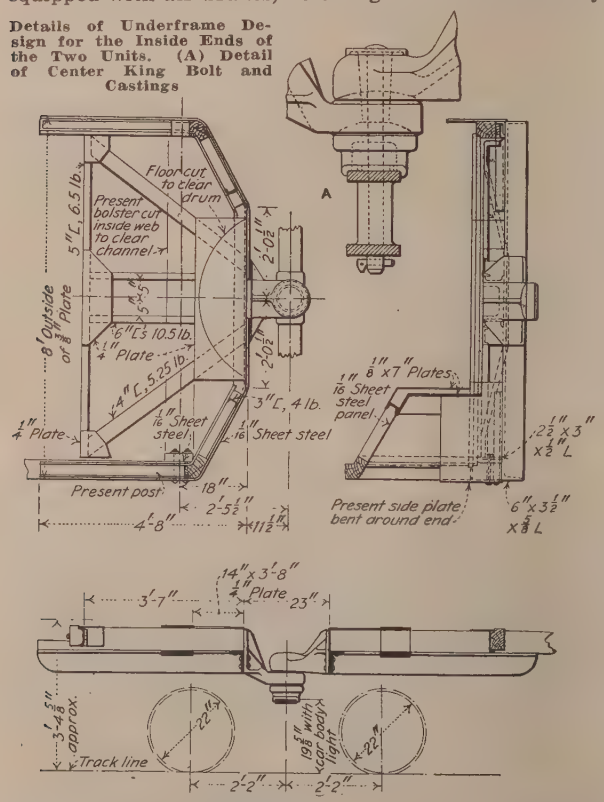


At Left, the Center Vestibule Drum Effectively Closes the Space Between the Two Units and Is Supported by Straps to the Truck. At Right, Support for the Inside End of the Two Units Is Provided by Swivel Castings. A Standard Trail Truck Is Used

in one, while the flexible leads which extend between the two units terminate in a set of four-prong plugs in the other part. Angles riveted to the outside portions provide for bolting these two parts permanently together. The leads do not need to be disconnected from their terminals in order to separate the two units. All that is necessary is to loosen the bolts and to spread the two parts of the junction box by turning a special screw at the center of the terminal, which gives sufficient pressure to separate the plug and socket connections. The junction box is made of $\frac{1}{16}$-in. sheet steel lined with $\frac{1}{4}$-in. transite. The terminal boards are made of hard maple, painted with insulating compound and otherwise protected.

The operating equipment of the original cars consisted of four Westinghouse No. 101 motors. The outer end trucks are retained in the duplex car, so that the complete unit is operated by four of these motors. The center truck has no motors. The control equipment, which has also been retained, consists of K28-L controllers. A line switch for opening and closing the circuit underneath the car is operated from contacts on the controller drum. As the cars originally were equipped with air brakes, no change has been necessary

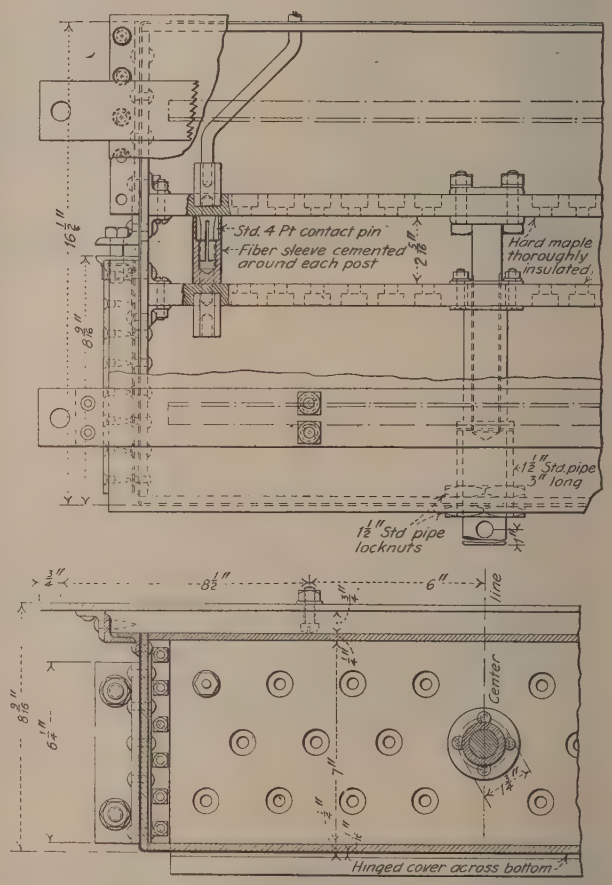
Details of Underframe Design for the Inside Ends of the Two Units. (A) Detail of Center King Bolt and Castings



in this equipment other than to provide an emergency valve for each unit. Connection to the operating emergency valve is made by an emergency cord, running the length of the two units.

The cars before reconstruction had semi-inclosed vestibules with gates and permanent steps. In the reconstruction the bulkhead was removed between the platform and the body of the car and the platform was lengthened 8 in., so that it has a length of 6 ft. 2⅜ in. from the bulkhead over the bumpers. Two folding doors and a folding step were added to the left-hand entrance side and a sliding door to the right-hand exit side, on diagonally opposite corners. The folding doors are operated by Consolidated Car Heating Company's pneumatic door engines, which are installed over the doors. These are pneumatically controlled from a station at the opposite side of the platform, just where the bulkhead was previously. The sliding door is manually controlled from a control lever at the front and right of the motorman's operating position. Special control features provide for the interlocking of the door control circuit, so that the doors cannot be opened until the car stops.

Electric coin boxes are used for collecting fares.


Std. 4 Pt contact pin
Fiber sleeve cemented around each post
Hard maple thoroughly insulated
1 1/2" Std. pipe 3" long
1 1/2" Std pipe locknuts
Center line
Hinged cover across bottom

Junction Box Used for Main Power Circuit So That Units Can Be Separated Without Disturbing Connection Leads

The depositing of a nickel in the slot of these boxes rings the fare register, which is located just inside the body.

Enameled stanchions were added to the platform, and a chain directs the flow of passengers on the front end. This chain runs from a central vertical stanchion, and hooks to a stanchion at the left-hand door entrance. The inside end of this chain runs over a sheave, so that by unhooking the end the chain drops into the upright stanchion out of the way.

Cross seats are used except at the entrance and exit ends, where short longitudinal seats are installed on either side. The hand straps which were in the original cars were removed, and porcelain enameled rods have been substituted. These are substantial and sanitary and have a better appearance than the hand straps. The new lighting arrangement has thirty-two lamps of 23-watt size arranged in two rows over the aisle ends of the seats. These have globes supported by Schroeder spring-type lamp fixtures.

The regular entrance is at the rear, but there are exit facilities at both ends. Signs are provided within

the car at the center end of each unit on either side of the drum vestibule, and also over the center vestibule, directing passengers to leave by the front door. Attention is called to the fact that this should reduce the average length of stop and that passengers alighting have an opportunity to cross the street before vehicular traffic proceeds.

Special attention has been given to providing exterior signs which will direct passengers as the car approaches. Routing and destination signs are conspicuously displayed. A large sign below the window on the front and rear of the car reads: "Enter at Rear and Have Exact Fare." In the center above the window is a curtain type destination sign, and on either side of this are two route signs. Route and destination signs are also displayed at sides at the end windows.

The present painting of the car corresponds to the standard red and yellow painting scheme used in Brooklyn. The interior is painted a light color to assist in providing ample illumination.

Rail Corrugation Experience

Survey of Railways in Various Parts of the Country Brings Out Interesting New Data as to Extent of This Trouble; Practices Followed in Removing and the Cost, and Comments as to Causes of Corrugation

RAIL corrugation, the cause of which is still as baffling as ever, is a problem of considerable magnitude to the men responsible for expenditures for track maintenance. This is clearly brought out in the summaries of present-day experience by the track engineers of a number of electric railways throughout the country, as presented by cities in what follows:

There is no uniformity of experience as to the type of construction or type of rail on which corrugation is most likely to occur. The length of the waves is reported to vary all the way from 1½ in. up to 8 in., and this appears to vary with the kind of equipment operated, i.e., single car, multiple-unit train, electric locomotive, etc. All reports agree that no definite relation can be found between length of wave and wheel diameter, and there is similar agreement as to any direct relation between number of wheel passes and the start of corrugation. But there seems to be some consensus of opinion that after corrugation starts the rate of development is then in proportion to the number of wheel passes. Joints, in general, are not considered a source of corrugation origin. Other ideas about corrugation and the best method of preventing and removing it differ considerably on the individual properties.

The Chicago Surface Lines during 1923, we learn from H. B. Fleming, chief engineer, found it necessary to grind out corrugation on 42 miles of single track. Corrugation in this city is found under many different combinations of construction and traffic. It is found on practically all types of track used in Chicago with the exception of high T-rail. Many attempts here to determine the effect of different types of construction have given no consistent results from which conclusions could be drawn. Neither has comparison of the results obtained with rigid concrete foundation track and track with crushed stone ballast.

Three years ago a change was made in rail laid from Lorain section 129 to section 130. Some of the latter,

The Special Double-End Grinder Used in Pairs on the Chicago Surface Lines to Remove Corrugation

laid on the old foundation on Wabash Avenue, where traffic is extremely heavy, has shown very little corrugation after three years of service, whereas the 129-lb. section previously had corrugated badly after less than a year in service. In this case the new rail was laid on the old foundation and no other change in the construction made.

Corrugations in Chicago are of various lengths and depths and develop under various combinations of wheel sizes. No definite relation has been established between the rate of corrugation development and the number of wheel passes. In some cases sections of track under heavy traffic will be free from corrugation, while other sections of the same track under the same traffic and sometimes in an adjacent block will corrugate badly. After corrugation starts, it, of course, develops more rapidly under heavy than under light traffic. In some cases standard construction track has started to corrugate in spots almost immediately after being laid.

Several types of grinding apparatus are used for the removal of corrugation in Chicago track. Atlas grinders are used for small work, and also Chicago Pneumatic Tool hand grinders for cleaning up small spots. Kerwin grinders are used for cleaning up long sections. The Surface Lines developed a double end machine some time ago, which is particularly suited for the large amount of such work required on this largest of surface line systems. These machines were described in ELECTRIC RAILWAY JOURNAL Sept. 23, 1922, page 452. They are frequently operated in pairs, as shown in an accompanying picture. The ordinary Kerwin grinder was equipped with four grinding wheels instead of two, which permits the work to be done twice as fast with the same crew of two men. The front pair of wheels takes the initial cut and the rear wheels do the finishing. Strand grinders are also used for some classes of work in Chicago. Reciprocating machines have not been found satisfactory for this work and are not used, the primary objection to them being that they are too slow. It is recognized that the reciprocating grinder makes it possible to get a very fine finish, but this is not considered essential for practical purposes and hence not superior to the more rapid rotary grinder.

Grinding is done at night on heavy traffic streets or sometimes throughout the full twenty-four hours. The practice is to use crossovers and single-track the cars past a section 200 to 500 ft. long at a time, depending on conditions existing on the street on which the corrugation is being removed. The Atlas grinders are used under conditions where it is desirable to take the grinder off the track between cars.

No allowable depth of corrugation before grinding is determined. It is the practice to remove it as rapidly as it develops and this is carried out as far as the equipment available and the personnel will permit. If a section of rail becomes too badly worn to permit of grinding economically the rail is removed.

The experience in Chicago is that corrugation tends to destroy the entire track structure, as well as to cause rapid destruction of equipment and discomfort to passengers. After grinding, there is apparently no definite cycle of recurrence, although careless workmanship will cause corrugation to develop again because it was not entirely removed. There is no evidence that it develops on properly ground rail any more or less rapidly than on new rail. The grinding, of course, affects the life of the rail in proportion to the amount of metal which must be removed. Maximum economy in rail life is believed to be obtained by grinding as soon as any evidence of corrugation is found.

As said before, very little trouble has been experienced in Chicago with T-rail. Installations of 7-in. 91-lb. Lorain section in 1908, laid with beveled tie plates which tilted the head of the rail inward slightly, have shown very little corrugation.

CLEVELAND CORRUGATION OF SMALL EXTENT

The experience of the Chicago company with tilted T-rail is corroborated by that of the Cleveland Railway. Charles H. Clark, engineer maintenance of way, reports that the Cleveland Railway has no corrugation to speak of on straight track. There has developed once in a while a soft spot in the track with slight corrugation, but little notice has been taken of it. For a number of years the company has tilted its rails 1 in 25. It has been Mr. Clark's opinion that corrugation starts at the gage line of the rail where the gage line of the wheel produces very heavy pressure and causes the steel to cold roll and flow ahead of the wheel in waves. By tilting the rails the pressure of the wheel has been transferred to the middle third of the wheel tread, and as to the result, Mr. Clark says, "The answer is that we have no corrugation on straight track," except as noted above in small degree where soft spots develop. Some severe corrugation, however, has been experienced on long radius curves in paved streets where the cars make 25 m.p.h.

PITTSBURGH FINDS TIGHT TRACK ONE CAUSE

After a several months study of rail corrugation on the Pittsburgh Railways, I. E. Church, special engineer, reached these general conclusions:

"After a thorough inspection of our track we came to the conclusion that all track corrugates more or less. In other words, that the rail in wearing down wears unevenly. The main difference is in the closeness of the unevenness. When the high and low spots are greater in length than about 6 in. the car will roll over the track smoothly, but when they are closer together the car begins to bounce and the corrugations become noticeable. With the aid of a few strokes of a reciprocating grinder, I could find these hills and hollows on any rail.

"Now, then, the question is what conditions contribute to shortening up these depressions to bring the rail to the condition popularly known as 'corrugated.' With our track I found that the one universal condition that always applied, no matter what other conditions might or might not be present, was tight track. If we had from $\frac{3}{8}$ in. to $\frac{1}{2}$ in. between wheel and track gage the corrugations were far enough apart to cause no trouble and hence could be classed as 'uncorrugated.' Our standard difference between wheel and track gage is $\frac{1}{4}$ in., but during 1920 a slight mistake was made in the track gages so that all rail laid during that year was laid too tight and it is all corrugated. We, of course, have track corrugated that was laid to our standard, but in the majority of cases there are spots or sections where the rail was pulled closer or has distorted enough to make it a little under gage.

"We also have corrugated track that is a little wide of gage, but this is mostly at points where the subsoil has sunk, leaving the ties hanging to the rail and the whole supported by the pavement.

"With our type of track construction, I would say

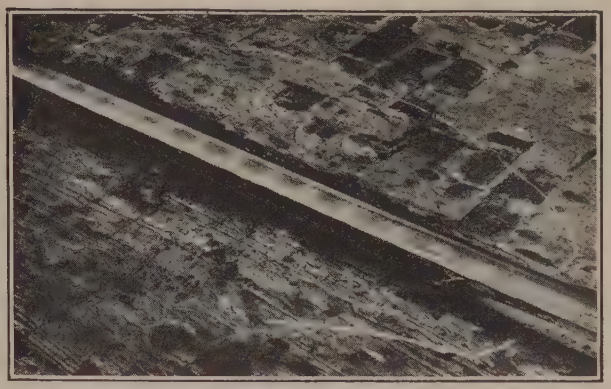
that if we would allow from ⅜ in. to ½ in. difference between the wheel and track gage and always have the ties resting on a good foundation we would never be bothered with corrugations on straight track. As to curves, if the radius is such as to allow a car speed greater than 7 m.p.h. the track will corrugate no matter what other conditions apply."

COLUMBUS, OHIO

E. O. Ackerman, engineer of way Columbus Railway, Power & Light Company, Columbus, Ohio, writes that corrugation occurs on almost every track on the Columbus system, requiring periodical removal by grinding. The extent of the corrugation can be judged by the fact that the cost of its removal is approximately $10,000 per year. The corrugation develops more quickly on rail wherein the wheel bearing is close to the gage line. The lengths of corrugations are about 3 in., this being almost uniform throughout the system. Mr. Ackerman says that he has never discovered any relation between wheel diameter and the length of rail corrugation. Similarly, the number of wheel passes bears no definite relation to the rate of corrugation, except that for each individual case an increased number of cars increases the corrugation, which is of course to be expected. The rate of corrugation development differs so much on different lines and different rails that no definite method of determining the rate, except observation, has been employed.

The method followed in Columbus to remove corrugation is to use a reciprocating grinding machine until the corrugation is entirely removed. The rapidity with which this can be done depends upon the depth to which the corrugation has been allowed to develop. It is endeavored to remove it as soon as it is plainly visible. By so doing, the damage to the rail is reduced to a minimum. On the other hand, if corrugation is not removed, it tends to shatter the foundation and pavement and loosen the entire structure, as well as damage the car equipment. Removing corrugation by grinding does seriously affect the life of the rail. The damage caused by corrugation on the Columbus railway system is placed at not less than $25,000 per year. After grinding, corrugation will reappear, the rapidity of this depending on the position of the wheel bearing on the rail.

Both These Tracks on Main Street, Columbus, Ohio, Were Built at the Same Time. Corrugation Developed on the Left Track Where the Wheel Bearing Was Close to the Gage Line. No Corrugation Has Developed on the Right Track, Where the Bearing Was Considerably Away from the Gage Line



Appearance of Corrugated Rail in Columbus, Ohio, After It Has Been Rubbed with Reciprocating Grinder Sufficiently to Brighten the High Portions

The reciprocating machine manufactured by the Railway Trackwork Company, Philadelphia, is used by the Columbus company for removing corrugation. A photograph reproduced herewith plainly shows corrugation on the rails of one track laid to bring the wheel bearing close to the gage line, while on the rail of the other track built at the same time, but laid to bring the wheel bearing considerably away from the gage line, there is no corrugation. Both tracks have been subjected to equal traffic.

The organization for grinding work consists of two crews of three men each, who operate two grinders.

PHILADELPHIA, PA.

In Philadelphia, W. K. Myers, vice-president Philadelphia Rapid Transit Company, advises, the amount of corrugation is comparatively small. This is attributed to the fact that corrugation is never allowed to get much of a start. As soon as evidence of it occurs the grinding machines are put to work.

Corrugation occurs most generally on track which is noticeably loose, and also on track with concrete stringers under the rail. The corrugations vary from 2 in. to 6 in. in length.

Some years ago the P. R. T. developed a machine for measuring the lateral vibration of rail heads under load. The action of this machine was described in an article by J. H. M. Andrews in the ELECTRIC RAILWAY JOURNAL in September, 1910. In recent years no investigation work has been done, and Mr. Myers comments that instead of attempting to solve the theoretical problem, effort has been directed toward giving prompt attention to incipient corrugation and preventing its development.

The method employed for removing corrugation is to use a reciprocating grinder with a crew of three men. This outfit can do about 125 ft. per day under the normal conditions of traffic. If the corrugation is well developed, it is necessary to remove the crest of the waves with a Universal rotary grinder, after which the reciprocating grinder is used to finish. The cost of grinding corrugation under average conditions is about 8 cents per foot of track.

Commenting on the destructive effect of corrugation, Mr. Myers said:

"Corrugation destroys paving and track structure. Whether loose track causes corrugation or corrugation causes loose track has never been definitely settled in our opinion. There is no doubt that should corrugation

occur on track which is not loose it would rapidly become loose.

"It is our experience that corrugation is apt to recur. If thoroughly removed, however, and the track reconstructed and well tamped, the probability is that it will not return. We do not believe that the removal of corrugation by grinding seriously affects the life of the rail."

Los Angeles, Cal.

B. H. Eaton, engineer way and structures Los Angeles Railway, states that this company has not had serious trouble with corrugation to date. What has occurred has been almost exclusively in solid concrete construction, except occasionally on curves. An interesting observation is that it has been found on curves with certain radii, namely, anything around 65 ft. or 300 ft.

The length of corrugations varies from 1½ in. to approximately 8 in. Corrugation seems to develop more or less in proportion to the number of wheel passes. However, a few exceptions have been noted where it has occurred quite extensively under very few wheel passes.

For removing corrugation the company makes use of a specially built car equipped with two 25-hp. motors. Grinding blocks are suspended from the body of the car on either side between the wheels. These blocks are of carborundum, 2 in. x 2 in. x 8 in., and are forced down on the rail by a system of levers and springs which produce between 400 and 500 lb. pressure. Both rails are ground simultaneously. The car is operated back and forth over the track after regular service has been discontinued. It will grind about 2,000 ft. in three nights work. This car is said to operate very satisfactorily and is the cheapest method the company knows of for removing corrugation. Two men operate this car at a labor expense of $10.60 per night.

Corrugations are never permitted to get more than ⅛ in. deep. If corrugation is allowed to develop unhindered, it will soon destroy the entire structure, usually cutting into the ties, loosening the rail and destroying the pavement by a vertical movement. As to recurrence, the Los Angeles company has a number of locations where there has been no recurrence after grinding. However, the more common experience is that corrugation does reappear. This is particularly true in solid concrete construction.

San Francisco, Cal.

B. P. Legaré, engineer maintenance of way and construction Market Street Railway, San Francisco, reports that this company has had a great deal of corrugation on its lines; in fact, nearly every line has developed corrugation to some extent. It has occurred most commonly in rigid concrete construction. The length of corrugation varies. It begins in short waves, a small fraction of an inch long, and if allowed to run for a long time will become 6 or 8 in. long.

The method and equipment employed for removing corrugation in San Francisco are very much the same as that just described for the Los Angeles Railway. No attempt has been made to figure the cost of removing corrugation. It is considered work that has to be done regardless of the cost. The experience is that corrugation returns after it has been removed. Certain track in San Francisco has been ground five or six times in the last ten years. This grinding seriously affects the life of the rail, as the head is being ground off instead of worn off by wheels.

Experience from Other Cities

The extent of corrugation in Little Rock, Ark., according to John Card, Arkansas Central Power Company, is 1,300 ft. of track out of 50 miles. All corrugation has occurred in track in pavement, and the corrugation varies from 5 to 7 in. in length. A reciprocating track grinder is used for its removal, which can be done at the rate of 5 ft. per hour at a cost of about 20 cents per foot. Corrugations are permitted to get from ⅛ to ¼ in. deep before grinding. The grinding not only wears out the rail faster, but it has a tendency to harden it. And corrugation returns more rapidly than it first developed.

F. B. Walker, chief engineer Eastern Massachusetts Street Railway, Boston, reports that this company has 175,000 ft. of rail corrugations per year, mostly in 9-in. girder rail in paved track. Ten reciprocating grinders work continuously during the entire track season, each machine having three men, on a program of removing corrugation as soon as it appears. These machines will each grind from 150 ft. to 300 ft. per day at a cost of 9 or 10 cents per foot of rail. Corrugation does recur in some cases, particularly if the rail is loose on the ties.

Approximately 25 miles of corrugated track out of a total mileage of 484.5 is estimated as the amount existing on the Boston Elevated Railway by H. M. Steward, superintendent of maintenance. It is common to all types of track construction employed in paved streets. The lengths of corrugation vary up to 4 in. Rotary and reciprocating grinders are used for removing corrugation and the speed of grinding with varying depths of corrugation averages about 20 to 25 ft. of rail per hour. This is done at a cost of 23 cents per foot of rail.

Effort is made to remove corrugation soon after it appears. Preference is given to track over which service is heavy and frequent. If allowed to remain, the corrugation will cause rapid deterioration of the track structure on adjacent paving. Corrugation does recur after grinding. Its removal by grinding does not seriously affect the life of the rail.

An interesting special case of corrugation is reported from Bangor, Me. E. W. Jennison, engineer maintenance of way Bangor Railway & Electric Company, states that on one of the two tracks at a sharp change in grade corrugation has occurred, but not on the other track. The track where the movement is down grade and onto the level there is no corrugation. The corrugation has occurred on the track for traffic changing from level to the up grade. Another case of corrugation in Bangor has occurred on the rail through special trackwork. The paving in both cases cited is wood block on a concrete base. The corrugations are approximately 3 in. long and have occurred only in girder rail.

The only place where corrugation has developed in the track of the Key System Transit Company, Oakland, Cal., has been on very rigid construction, mostly on 141-lb. girder rail laid in concrete. But the amount is small, according to H. O. Demeritt, engineer maintenance of way and structures, and only a few nights each year are devoted to grinding off corrugations.

George N. Cole, engineer Second Avenue Railroad, New York City, attributes the fact that this company

has no corrugation on its tracks to the use of cast iron wheels instead of steel wheels.

R. N. Wade, engineer maintenance of way Chicago Rapid Transit Company, writes as follows in regard to corrugation on the elevated lines:

"As you know, all track on the elevated railroad is open track, and we have no trouble with rail corrugation except on the curves. This, I believe, is due to the combined motion of the wheels slipping and the trucks slewing; that is, moving backward and forward in the throatway between the restraining and the running rail. This is also due to a certain extent to the application of power on the curves.

Corrugation in New Bedford Is Removed by Welding on New Metal

At Left, the Welded Strip Is Ground Down Smooth, but the Metal of the Original Rail Is Not Touched.. At Right, the New Metal Is Laid ½ In. Back from the Gage Line

"Most of our curves wear out due to corrugation, but we do not grind them, as we have found it is cheaper to renew the rail. When the rail becomes so badly corrugated that it is noisy and the trains ride over it uncomfortably we take it out."

Building Up Corrugated Rails by Welding

A most interesting treatment of the problem of removing rail corrugation is that recently brought to light by the visit of a JOURNAL editor to the New Bedford Mass., property. T. W. Williams, engineer maintenance of way Union Street Railway, makes a practice of building up badly corrugated rail by welding, thus giving it a new tread. This is done with an Indianapolis welder.

Three seams of metal are welded to the tread parallel to the length of the rail, the nearest being ½ in. from the gage line. The rail must be clean when the welding is done and care must be taken to keep away from the gage line. If the latter is not done, the welding material is likely to spatter and spoil smoothness of the gage edge. After the head of the rail has been built up by welding on these three strips the surface is partly ground down again. The grinding, however, is not carried to a point where the original metal of the rail is affected.

After having been treated in this way, the rail surface is good for one and a half to two years service before new corrugation develops. Hard steel electrodes are used and it has been found more advantageous to do the work in hot weather because of the unequal contraction which afterward occurs if the welding is done during cool weather. The corrugation with which the New Bedford company has to deal is principally at points where the cars are braked for a stop.

Nearly every one has his own theory of the cause of corrugation, but the method of avoiding corrugation employed by J. M. Mudie, chief engineer Detroit United Lines, seems to be as dependable as any. He says: "I am frank to admit that none of my theories regarding the cause of corrugation stand up under all conditions, and I am inclined to believe that keeping one's fingers crossed is about as good a method as any of avoiding this trouble."

Experience of a Track Consultant

Drawing upon the experience of H. P. Hevenor, consulting engineer, New York, who has had an extensive consulting and contracting experience in connection with electric railway track, we get a somewhat broader view of the subject. His experience with respect to corrugation covers rapid transit lines where multiple-unit trains are operated; railroad tracks where the service involved multiple-unit trains, electric locomotives, and steam locomotives, and surface street railways both in paved and open track. His observations follow:

"It has been my experience that corrugation occurs most on surface lines of girder rail and wood tie construction with concrete paving base between the ties and a block form of pavement. On girder rail I have seen lengths of corrugation vary from 2 in. to 8 or 10 in. On T-rail I have never seen corrugation run less than 3 in., with an average of about 4 in. Under multiple-unit operation corrugation very seldom runs less than 6 to 8 in.

"I have never found any direct relation between wheel diameter and length of corrugations other than the difference in lengths of corrugations under trolley use and multiple-unit operation. There is a definite relation between corrugation and the number of wheel passes. When corrugation once starts it is only a question of the number of wheel passes before it becomes pronounced and eventually destroys the rail and the entire track assembly, including the paving adjacent to the rails.

"Development of corrugation has usually been brought to my attention by the depreciation of the track structure or the adjacent paving. But complaints from adjacent residents have also been a source of information as to the condition. In one instance, where a multiple-unit operation was used in an open cut, the jarring of the cars operating over track damaged by corrugations shook an entire house and broke glassware in the house.

"There is only one real method for properly removing corrugation and that is by means of what is known as a reciprocating grinder which gives a true planing

action on the top of the rail. I believe that removal of corrugation by means of a grinding wheel may remove the heavy corrugation, but it leaves a great number of microscopic cups, which in due time, under a sufficient number of wheel passes, will cause corrugation to recur. The reciprocating grinder is slower than the rotary grinder, and of course the time required for removing is dependent upon the depth of the corrugations.

"The cost of grinding will vary considerably with the chemical analysis of the rail, whether girder or T-rail, the width of the head or rail tread and the depth of the corrugations. The cost of removing corrugations by means of a reciprocating grinder usually is greater than by means of a grinding wheel, but there is no comparison in the value of the work after it is completed.

"Corrugation should be removed as soon as it can be visibly detected or identified, or before it has had an opportunity to loosen or harm the track assembly or the adjacent paving. It will absolutely destroy the track structure and the adjacent paving long before normal depreciation. I might also add that corrugated track is very hard on rolling stock, and the noise caused by corrugation is very annoying to passengers as well as the people living in the vicinity.

"If corrugation is properly removed in its early stages it oftentimes will not recur in the life of the rail; but if it is allowed to get to any depth, say to $\frac{1}{16}$ to $\frac{1}{8}$ in. in paved track, by removing the corrugations it will save the paving and track assembly for a few years, when it will most likely need to be gone over and the corrugation again removed. The cost of removing corrugation is so trivial compared to the cost of replacing the structure that the work is well warranted. However, in open track structure, it is my belief that when corrugation reaches this stage the rails should be replaced because of the harm done to the track assembly, thereby increasing the maintenance and the risk of derailment.

"Unquestionably, all metal removed from the top of the rail, in addition to that of normal wear, will have a tendency to decrease the life of the rail, but if this rail has corrugations on it, it will naturally add to the life of the rail to remove the corrugations. On the old deduction that the life of the joint is the life of the rail, the small amount of metal required to be removed to eliminate the corrugation in its early stages is not likely to have any effect on its future life.

Some Observations from Heavy Traction Experience

"I have found that corrugation is oftentimes introduced at and adjacent to station stops due to the heavy braking and the quick acceleration of trains. The electric locomotive does the least harm to the rail in this respect, the steam locomotive the most harm at the point of acceleration due to slipping of the wheels, while multiple-unit trains are a source of complaint from the entire territory in which they are operated.

"The causes of corrugation have been the source of considerable controversy, but I feel that most authorities will agree that it unquestionably comes from narrow track gage in most instances. It has been my personal observation that the single-truck safety cars are also the means, at times, of starting corrugations. Whether this is from the rigid wheelbase of the single truck I am unable to say, but I feel that this source should be watched by different men throughout the country. In another instance I found that corrugation started very quickly on one type of T-rail. A micrometer was used on an unused rail of this type and slight variations were found in the top of the head of the rail, after machining the base to a true plane. This may have been an exceptional case or it may exist in a number of instances.

"Corrugation in street railway construction has often been looked on as being more prevalent in the rigid type of track construction than in the flexible type of track construction, both in paving. I believe, from my own experience, that the rigid track construction will have less corrugation than the flexible.

"If corrugations are permitted to become of any excessive depth before they are removed, and are then planed to a level surface, the early recurrence of corrugation in this rail is due to the difference in the density of the metal as the steel is more compacted at the hollows than at the high spots. It might be an interesting research to find out the amount of compacting received by the rail at different depths of corrugation."

British Conclusions

In bringing together some discussion of the corrugation situation as it exists today, it may be well to include the conclusions of the Municipal Tramways Association of Great Britain. The final report of the sub-committee on rail corrugation dated April 29, 1921, confirmed the conclusions reached by the same committee in 1914, after extended additional study. These conclusions comprised experiments with rail supported in various ways to reduce the vibration. The conclusions follow:

1. Corrugation takes place on all rails under observation, varying only in degree and pitch.
2. On most rails corrugation is accompanied by pitting or crumbling, varying from a slight to a marked degree. This pitting appears most where corrugation ceases to develop cumulatively and in regular ridge and hollow form.
3. The pitting or crumbling appears to relieve the superficial molecular stresses induced by the causes of corrugation, and thereby eradicates, limits or modifies corrugation.
4. Corrugation occurs in ordinary grooved rail and on bull head rail and on rail with or without specially secured lateral stiffness and rigidity.
5. Differences in freedom of the rail for lateral vibration are not accompanied by any corresponding differences in either the occurrence or the severity of corrugation.
6. The corrugation of the Zell-treated rails did not differ appreciably from that of other rails.
7. Persistent corrugation occurs on straight lines where the slippage is least and where it is therefore least likely to be a contributory cause of corrugation.
8. Corrugation is removed at or near stopping places by magnetic brakes as fast as the cause of its origin tends to its production.
9. The corrugation of the tracks considered by the committee appeared in definite form on railways, such as the Metropolitan District, whereon the rails are of different form and differently fixed.

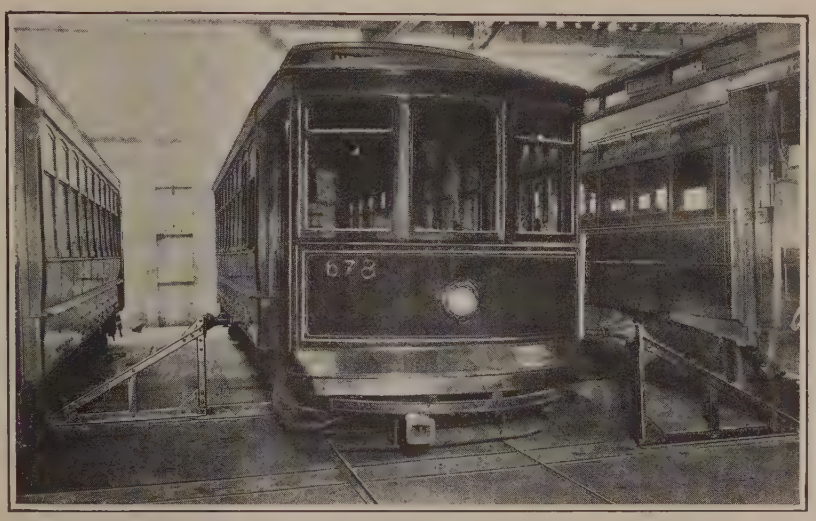
A further finding of the committee in its final report was that "corrugation of steel rails is inseparable from the action of the heavily loaded wheels rolling along the surface of the tread of rails, and this rolling originates the corrugation by giving rise to superficial stresses in the material of the rail tread, which are in excess of the elastic limit and of the toughness of that material."

Equipment Maintenance Notes

Car Straightening Device

WITH the increased use of steel side sheets and steel underframing for electric railway cars has come a demand for convenient equipment to assist in straightening bent sides and ends. These become twisted, warped or crushed out of shape from collisions with trucks or other cars, and if the bending is not too extensive it is most convenient to straighten out the bent portions without cutting out the steel sheets or understructure. A few railways have provided special straightening construction and equipment for taking care of this work, but the majority have no special facilities. On many roads it is quite common to bring the car in between two brick walls or between two iron columns and then apply jacks for straightening out excessively bent portions, while other parts are hammered out, if possible.

A special construction used by the Northern Ohio Traction & Light Company was described in the ELECTRIC RAILWAY JOURNAL for Feb. 2. The accompanying illustrations show a very simple, strong and portable equipment which is used in the shops of the Capital Traction Company, Washington, D. C. This construction makes use of anchorage beams installed in the floor of the shop. Jack braces are provided which can be placed in position by hooking the foot lugs at the bottom of these braces into slots in the concrete anchorage beams. The straightening of the bent part of the car is then carried out by means of screw jacks which are placed between the jack braces and car body.



Straightening a Car Body in the Shops of the Capital Traction Company

In the shop of the Capital Traction Company four anchorage beams are provided. These are of concrete 1 ft. 4 in. wide and 2 ft. 6 in. deep. The concrete is reinforced by ¾-in. and 1-in. round iron rods which have hooked ends. Iron plates are also provided to receive the hooked portions of the jack braces. An accompanying illustration shows the construction of the anchorage beam and also details of the jack brace construction.

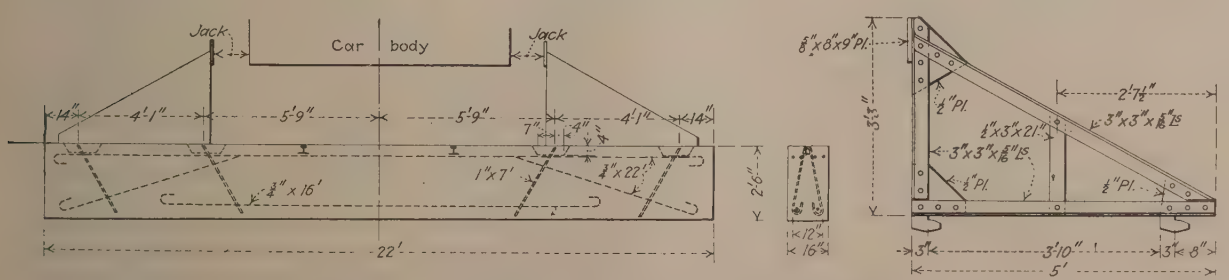
The jack brace is made of 3-in. x 3-in. x $\frac{5}{16}$-in. steel angles riveted together and having gusset plates at the corners and a crossbrace between the top and bottom members. Each brace is provided with two hooks at the bottom to fit into the plate of the anchorage beam and hold the brace firmly in position, when pressure is applied.

The method of applying pressure and straightening a car is illustrated by the accompanying photograph. A particular advantage of this construction is that the jack braces can be placed in position and removed very easily, so that the entire floor area is available for other work when the straightening work is not being carried out.

Plug-Cutting Bit for Finishing Screw Holes

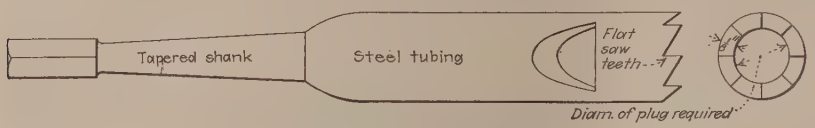
AN ATTEMPT is being made at the Throop Street shops of the Chicago Rapid Transit Company to eliminate from the interior trim of the car all screwheads by counterboring the head and placing a wooden plug of the same material as the trim on top of the screwhead. Thus on the side posts, wood panels and end panels of the car no indication of the screws which hold the wood to the steel framing mar the finish of the trim.

To obtain the necessary plug from



Details of Anchorage Beam and Jack Brace for Car Straightening

a piece of material of the same character and grain it was necessary to devise a plug-cutting tool which would turn these plugs out at a rapid rate and at the same time have them accurate as to size. In the construction of this tool, or bit, a piece of steel tubing whose inside diameter corresponds to the required diameter of the plug is securely fastened to a taper shank which will fit conveniently into the drill press or horizontal wood drill. The other end of the steel tubing is serrated by hand into a number of flat teeth. A notch is made in the steel tubing about ½ in. from the saw tooth end in order that a small drift may be used to force the plugs out of the tool should they become lodged in there during the process of cutting. It has been found advisable to make these bits out of ⅛-in. stock and to have three or four sizes on hand which will cut plugs for the majority of screwheads. Forty plugs per minute may be cut by one man operating one of these tools, and it is the practice to make up a couple of hundred plugs at a time in order that the woodworkers will have an ample supply for a period ahead.



Details of Plug-Cutting Bit for Finishing Screw Holes

Notes on Modern Armature Repair Practice*

A Number of Methods Are Discussed that Make for Good Repair Work on Windings, Brushes and Bearings—High-Voltage Testing of Windings Desirable

BY JOHN S. DEAN
Westinghouse Electric & Manufacturing Company

THE armature winder should be provided with proper tools, including a rawhide mallet, steel and fiber drifts, screw driver and scissors. Improper tools in the hands of the average winder may result in a poor winding job. Best results can only be obtained by using armature coils made from a good quality of copper, insulated with high-grade fibrous material or a combination of fibrous material and mica wound to correct shape, with insulation reinforced at cross-overs and corners, and thoroughly treated by dipping and baking in a high-grade insulating varnish.

All sharp corners and roughness in the slots that might damage the windings must be removed by filing or by grinding with a small portable emery wheel. The insulating material placed on the coil support should be evenly spaced to avoid any thin spots. The coils should have a snug fit in the slots and should be laid in so that their tops extend about 3/32 in. above the band grooves. This is important to get a good banding job. In winding the coils they should not be twisted, bent or otherwise abused. Insulating or protecting pieces should be placed at all points where coils cross and where there is danger of short circuiting.

In soldering the leads to the commutator the iron should preferably be held on the side of the commutator rather than on the top, and the pinion end of the armature raised 6 or 8 in. This procedure tends to prevent solder running back of the neck and short circuiting adjacent bars. If the armature coil leads are well tinned, experience has shown that it is not necessary to tin the commutator necks. An acid flux will tend to weaken the fibrous insulating material on the windings and should not be used. The best practice in soldering is to use a high percentage tin base solder for wire-wound armatures and pure strip tin for those that are strap wound.

DIPPING AND BAKING

On many roads, armatures are partly banded and then heated twelve to twenty-four hours, depending upon the size, and dipped, pinion end down, in a good grade of black insulating varnish. After draining they are baked at a temperature of from 95 deg. to 105 deg. C. for forty-eight to seventy-two hours depending upon the size. This treatment fills the crevices in the armature and acts as an effective bond to prevent vibration.

Best results in banding armatures are obtained by drawing the windings down in place by temporary bands after they have been heated. For the final bands a good grade of tinned steel banding wire, ranging in size from No. 14 to No. 17 B. & S. gage, with tensions from 100 to 350 lb., is best. Phosphor bronze wire is used for bands by some operators, but the following comparative test results show plainly the superiority of the steel for this purpose:

	Ultimate Strength, Lb.	Elongation, Per Cent
High grade steel	267,000	36
Phosphor bronze	157,000	15

Strips of tin placed under the core bands tend to strengthen and make them less liable to work loose in service. Bands should be soldered with pure tin as it has a higher melting point than the half-and-half solder.

TESTING ARMATURE WINDINGS

On a number of properties repaired armatures are given an insulation test of 600 volts, through a bank of lamps connected to the trolley circuit. This test is not severe enough to weed out the defects in the winding due to poor material and inferior workmanship. A railway shop should be equipped with a high-voltage testing box. All newly wound armatures should be tested at 2,000 volts to ground and repaired armatures at 1,000 volts.

FIELDS AND BRUSHES

To insure the proper speed of the motor, the field coils must have the correct number of turns. The wound coils should be carefully insulated and thoroughly impregnated with a high melting point asphaltum gum. This treatment produces a coil that will best resist heat and moisture. Revamping old field coils by burning off the old insulation and reinsulating should only be done under careful supervision, as there is danger of damaging the copper. A 30 per cent increase in the resistance of a revamped coil was reported by one master mechanic, which in his estimation was due to burning the copper when the coil was heated to remove the old insulation.

It is considered best practice in connection with modern motors, and is also recommended for old motors, to use cables coming out from the body of the coil instead of the heavy brass terminals, which are more

*From a paper read at the meeting of the Midwest Electric Railway Association, Springfield, Mo., Jan. 17, 1924.

likely to break off, due to vibration, or to develop loose connections and burn off the leads. Another objection is the difficulty of properly insulating the terminals after the connections are made. Field coils mounted in the frame should be spring-supported, to keep them tight on the poles and prevent vibration and chafing. As a precaution it is advisable to test the polarity of the coils after they are assembled in the frame.

To improve the operation of brush holders, keep the porcelains clean, the shunts in good repair, the mechanism working freely and spring tension approximately from 6 to 9 lb., depending upon service conditions. Brush holders with a single carbon per box are more likely to give trouble than those using split carbons, due to reduced spring pressure, by having the circuit broken at the brushes, with resultant tendency to flash. Brush holders should be properly aligned on the neutral position, usually at the center line of poles, adjusted about $\frac{1}{8}$ in. from the surface of the commutator, and spaced around commutator one-quarter of the number of commutator bars on a four-pole machine. The general feeling is that brush holders that need repairs or adjustment should be replaced by others in good condition and the defective ones sent to the shops.

The use of high-grade carbons more than pays in the form of increased life of brushes and commutator and improved operation of the motor. Carbons should have a snug sliding fit in the boxes. They should not be copper plated as the plating is liable to peel off and jam the carbon. Shunts on carbons are not necessary as the modern brush holders have the shunt as a part of the brush holder pressure finger. The average life of carbon on non-ventilated motors is from 40,000 to 50,000 miles, while from 8,000 to 10,000 miles is a good average on ventilated motors. This comparative short life of carbons on the ventilated motors is due to rapid side wear of the carbon, caused largely by the action of the dust and dirt drawn through these motors. A number of operators are using a single carbon per holder instead of the split or double carbon and reports indicate that they show less side wear on ventilated motors and give a higher mileage. This scheme shows a decrease in the cost of carbons per holder of about 15 per cent; further, they are more easily renewed, hence are favored by the carhouse men. On the other hand, the single carbon tends to wear uneven on the end and is more likely to jump off the face of the commutator and cause flashing of the motor.

BEARINGS

The tendency of present-day practitce is to use bronze armature bearings lined with babbitt and plain unlined bronze axle bearings. In the manufacture of bearings a high grade of bronze alloy should be used and great care and attention should be paid to the details of the various manufacturing operations. Armature bearing shells should be carefully tinned and lined with a high-grade tin base bearing metal. They should be given from 0.008 in. to 0.010 in. initial clearance and be pro-

Dick Prescott Goes to Work

and Gets a Chilly Reception

WHEN Dick reported for work the next morning after having been so abruptly hired by Thomas Mullaney, the general foreman, he wore clothing that he thought would be suitable for the rough work as a carpenter's helper which he agreed to take when he was told that the shops of the Consolidated Railway & Light Company did not have an engineering department. In addition, he carried under his arm a small roll containing a suit of overalls.

After punching his time-clock number he followed the instructions given by the timekeeper and started out to find Steve White, the carpenter foreman.

When he entered the door of the little office, built into the corner of the carpenter shop, the round-shouldered, slightly built man who sat before a small battered desk was busy sketching on a pad of paper.

"Are you Mr. White?" asked Dick as the man at the desk looked up.

"Yes. What can I do for you?"

"The timekeeper told me to report to you," said Dick.

"Oh, you're the new helper the boss hired yesterday. Say, just sit down over there for a few minutes until I get this sketch finished and I'll be right with you."

Dick sat down on the makeshift chair indicated, and waited for several minutes in respectful silence. A boy perched in front of a small window opening into the shop was busily handing out job tickets to a number of heavily clad men who stared curiously at Dick as they called out their numbers.

"George," said the man at the desk, suddenly tearing off the sheet on which he had been working from the rest of the pad, "take this sketch right over to old man Johnson in the mill and tell him to make up six pieces like that right away. Tell him we've got to get that car out tomorrow afternoon."

As the boy departed, White turned to Dick.

"Now, young fellow, got any tools?"

"No, I haven't," said Dick, "I thought it would be better to get your advice on what I would need."

"Well I guess you can get along today all right."

Just then the carpenter foreman caught sight of the small bundle under Dick's arm.

"For the love of Pete! That's not all the clothes you brought?"

"Why-y, yes; I have a pair of overalls here and I thought that would be all I would need."

"Overalls! Say, young fellow, what you need here is some overshoes! You can't work in this shop in that outfit—you'll freeze to death. You need some good heavy clothes to wear under your jumper, and some heavy gloves. This shop's as cold as an ice house."

"I'm mighty sorry, Mr. White, but I'll have everything I need in the morning. I thought my overalls would be plenty warm enough for work inside."

"That's the way it ought to be, but I haven't had any luck convincing the old man. I lost several good men this week because we couldn't get more heat. We'd save money by enlarging the heating plant 'cause a man can't do good work all bundled up. But just the same we've got to make the best of it and you'll have to bring down some heavier clothes tomorrow. You can give George a hand in the office today and help him get his time records up to date."

In the meantime, George, the clerk, had found old man Johnson in the mill and handed him the hurriedly made sketch.

"Steve wants to get them made up right away. Says they gotta get that car out tomorrow."

"Yeh? Det ban same story ever' time; hurry, hurry, hurry. Den nutt'n come right. How many pieces he want?"

"Why, I guess he said four pieces."

Still muttering under his breath, and not stopping to question the boy further to investigate the accuracy of his statement, old man Johnson started toward the lumber pile.

(To be continued next month)

vided with ample oil grooves, properly located. At least one of these grooves should extend to the radius at the bearing flange to supply oil to the rubbing surface between the bearing flange and the wiper ring. These bearings should have approximately 3 to 5 tons press fit in the housings and in addition should be held by a key. Axle bearings should be given from 0.012 to 0.016-in. initial clearance. It has been found by experience that oil grooves are not essential. The bearings should be a tight clamping fit in the bearing seat and in addition should be provided with dowels or keys. Two end dowels in the bearing flange and one body dowel have proved very effective and are used in connection with some of the more modern motors.

The shells should be cleaned thoroughly before babbitting. Bronze shells that are to be lined with babbitt should be well tinned. Malleable iron shells can be tinned by first pickling the shell in a weak solution of sulphuric acid. A good tin base metal is preferred for babbitt lining, although a lead base metal has been used successfully. The latter requires extra care and attention to get good results. The bearing shell and mandrel should be heated before babbitting. The metal should be poured at a temperature of from 460 to 480 deg. C. This is best accomplished by equipping the babbitt pots with an automatic temperature control to keep the temperature of the metal within the specified limits.

Heat-treated axle steel and alloy steel shafts used in modern railway motors have given good results in service, and these materials are recommended for use on the older motors now using plain axle steel. Tests show that axle steel heat-treated is 44 per cent stronger than untreated axle steel, while the alloy steel is 77 per cent stronger. In addition, either material is more uniform in strength than untreated steel, is tough and fatigue-resisting, and will increase the shaft's operating factor of safety. Fillets must be provided at all changes in diameter. At the end of the pinion taper a large fillet is now commonly used in connecting with a shortened pinion key-seat. It is the practice on armatures using a spider to leave the key off and to depend on the press fit of the shaft in the spider. By thus omitting the key-seat in the shaft increased strength is obtained.

A number of operators believe that loose laminations on cores are largely responsible for broken armature leads. The older railway motor cores were built up with laminations that had a loose fit on the shaft or spider, and in the case of the spider construction were held in place by a ring key. The laminations on modern motors are now made a tight driving fit on the spider or shaft, depending upon the construction, and are forced down in place by means of a special air-operated cylindrical plunger type hammer. The ring key has been replaced by a ring nut to hold the laminations together as this design is more reliable.

Effective Hose Bridge

STREET car companies have difficulty in laying hose across streets because of objections due to traffic blockades and frequent damaging of valuable lengths of hose. The Market Street Railway, San Francisco, is

An All-Metal Hose Protector for Track Gangs

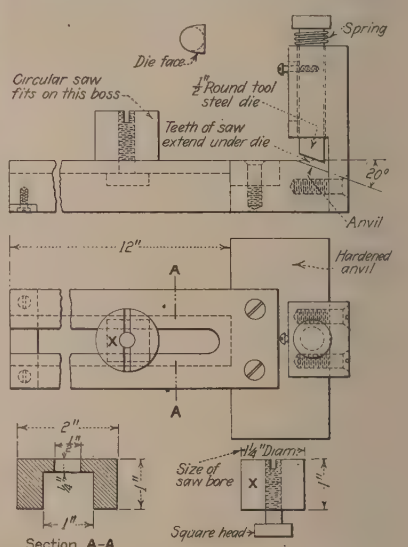
now using a bridge which is built of two wrought metal strips, tied together with iron straps that are also made of drawn material. The straps are curved to bring the long metal strips into an arch. Vehicles can run over the protector with little jarring and without injuring the hose.

Special Tool for Setting Circular Saws

AN INGENIOUS device has been made and is used in the Throop Street shops of the Chicago Rapid Transit Company for rapidly and accurately setting the teeth on heavy circular saws. By employing a blow instead of a leverage pull to deflect the tooth the desired amount, it is claimed that a more accurate setting is obtained in a shorter time than was the case with the ordinary hand saw set. Fundamentally, the device now used consists of a center to hold the saw, an anvil beveled to the proper angle and a die of the proper design arranged to strike the beveled portion of the anvil when actuated by a blow from a hand hammer.

The construction of the device is of mild steel with the exception of the anvil and die, which are hardened tool steel. The anvil portion is 1 in. thick, of rectangular shape, and measuring 2 in. x 4 in. Attached to one side is the guide for holding the boss or center upon which the saw revolves. The other long edge of the anvil is beveled 20 deg., forming the portion of the anvil on which the saws are set. An upright die holder or guide is fastened to the vertical face of the anvil piece by means of countersunk machine screws. The die is of tool steel and is cylindrical up to within ¼ in. of its face, which is semi-circular. This design gives a wide face to the die near the ends of the teeth, thus aiding in bringing them down to shape. A set screw in the die slides in a slot and prevents the rotating of the die, while a small compression spring located between the head and die support returns the die to its position after being depressed by the hammer blow.

An adjustable feature has been introduced in the manner of fastening the boss or center. A slotted



Assembly and Some Details of Special Saw Set

undercut guide accommodates a square-headed bolt, while the boss is threaded and acts as a nut in holding the bolt in any desired position. This boss for the particular saws used measures 1¼ in. in diam-

eter and was made 1 in. long in order to prevent the saw from jumping off when struck during the setting operation.

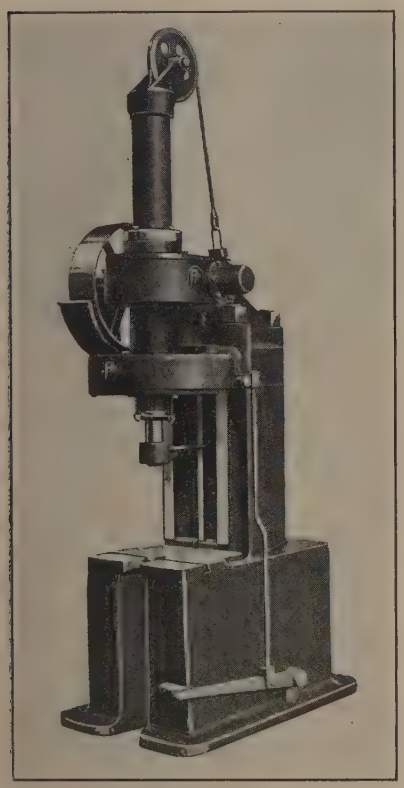
In practice, a saw is placed on the spindle and adjustments made so that the teeth will extend over the beveled anvil. Often the die support is used as a guide, bringing the ends of the teeth up to the support, but experience is the only guide for placing the saw. Alternate teeth are brought under the die and a blow is delivered by a hand hammer. Here again experience will dictate the number and intensity of the blows. After every other tooth has been set in one direction, the saw is inverted and the remaining teeth set.

In setting a No. 12 gage, 18-in. circular saw this device required the services of one man for about three hours, as compared with several days time for the old method. The accompanying illustration indicates the general dimensions and construction of the device, which may be used for saws having diameters up to 22 in.

New Equipment Available

New Screw Type Power Press

TO MEET the demand for a flexible power press, so that varying pressures can be applied and regulated without difficulty, the Fox Machine Company, Jackson, Mich., is placing a new line of power presses on the market. These are built in



Flexible Power Press

four sizes, with capacities up to 5, 10, 20 and 30 tons, respectively.

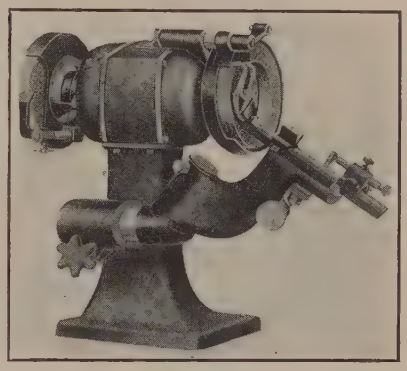
A power press in an electric railway shop is a very convenient tool, as in addition to the work of pressing in bearings and bushings a press finds ready use for straightening shafts and bent bars, pressing mandrels into work that must be turned in a lathe, broaching babbitted bearings, and assembling various parts where pressure is required. With these new machines the work is placed on a table and the depressing of a pedal causes the ram to travel down at a rapid rate until it comes in contact with the work, after which the pressure applied can be regulated by the pressure on the pedal. When the pressure on the pedal is released, the ram returns to its initial position.

The base of the machine is of heavy construction, with a slot down the front of the base under the center of the ram. This permits flanged shafts, etc., to be placed on the work table. The ram is made of high manganese chrome alloy steel, having a tensile strength of 135,000 lb. The ram has a quadruple thread of coarse pitch and two opposed splined keyways for drive in rotation. The nose of the ram has a hardened steel thrust cap, and also a special nose piece is provided so that a variety of different tools can be used at the end of the ram.

Pressure is regulated from the pedal through connection to a raybestos-lined band brake. Pressure on the pedal brings friction to bear on the band brake drum, thus arresting the rotation of the drum. When the ram comes in contact with the work, the pressure on the band brake regulates the slippage of the drum and thus governs the pressure of the ram against the piece placed on the bedplate.

Direct Connected Twist Drill Grinder

A BENCH type twist drill grinder made in three sizes is being marketed by the Gallmeyer & Livingston Company, Grand Rapids, Mich. The smallest size is suitable for drills from No. 60 to $\frac{3}{8}$ in., the second size for drills from No. 52 to $\frac{3}{4}$ in. and the third size from $\frac{1}{8}$ to $1\frac{1}{2}$ in.



Bench Type Twist Drill Grinder

The small machine is equipped with a $\frac{1}{4}$-hp. motor and the larger ones with $\frac{1}{2}$-hp. motors. The grinders carry $8\frac{1}{2}$-in. diameter grinding wheels, which run at 1,750 r.p.m.

The spindle of the grinder runs in high-grade ball bearings and is made of 60 to 80-point carbon, hammered crucible steel. The swivel stud is $2\frac{1}{4}$ in. in diameter, with the bearing the full width of the column. The drill holder is designed so that either straight shank or taper shank drills of standard type can be ground, and drills with enlarged shanks or drills mounted in quick-change sockets can also be ground with equal facility and without any changes or extra adjustment. The holder swivel bearing is $1\frac{1}{2}$ in. in diameter and $4\frac{1}{4}$ in. long.

The lip-rest of the grinder can be put on so as to use either edge for the drill support, and it can be reversed top or bottom, or to give four distinct settings. There is also an adjustment to provide for wear.

A diamond truing device is furnished as a part of the standard equipment. This truing device has a stop in the form of a track on a movable section of the wheel hood. As the diamond is advanced into the grinding wheel, this movable section of the wheel hood with its track is advanced an equal amount, so as to remain a fixed distance from the face of the grinding wheel. A circular stop on the front of the drill holder abuts against the track and rocks on it when swiveling the holder.

Association News & Discussions

New Englanders Discuss Welding, Economics and Public Relations

MARKED by noteworthy addresses upon public relations, engineering and economics topics, the program of the New England Street Railway Club's meeting at Boston, Feb. 7, attracted a large attendance and the close attention of representative traction men from all over the Northeast. President R. D. Hood occupied the chair. At the afternoon session R. L. Brown, New England manager Metal & Thermit Corporation, Boston, spoke on "Track Welding," J. B. Crawford, superintendent Concord Electric Railways, Concord, N. H., read a paper on "The Vanishing Railways" and C. Q. Richmond, general manager Berkshire Street Railway, Pittsfield, Mass., and Fred A. Cummings, assistant to the trustees Eastern Massachusetts Street Railway, Boston, spoke of pending legislative activities in Massachusetts. C. W. Kellogg, Stone & Webster, Inc., Boston, spoke on the A.E.R.A. regional committee.

Following the usual dinner at the Copley Plaza Hotel, addresses were made by F. E. Webster, vice-president and treasurer Massachusetts Northeastern Street Railway, Haverhill, Mass., on "Street Railway Accounting"; by Hon. Henry G. Wells, Massachusetts Department of Public Utilities, on "The Public and the Railways"; and by Rev. Dr. McIlyar H. Lichliter, Newtonville, Mass., on "The Spirit of 1924." The date of the annual banquet of the club was set for March 27 at Boston.

Welding by Thermit Described

Mr. Brown described the principles and application of Thermit welding and showed a large number of lantern slides from the Brooklyn Rapid Transit Company system illustrating the equipment and practice of this branch of maintenance activity. He pointed out that while the welding of locomotive frames is at present the largest application of the Thermit process, its use in track welding is extending so rapidly that in the future it is expected this will surpass the railroad shop development in magnitude. Recent improvements in the equipment include better facilities for preheating joints through the vaporization of kerosene. Ordinarily it requires from twenty to twenty-five minutes to heat the joint properly with a 7-in. rail. In the past two years the manufacturer has greatly simplified the operation of his equipment, reduced the amount of Thermit required per joint, and generally has speeded up production. Improved crucible designs have been put in service, and the No. 3 crucible now lasts for forty or fifty reactions before relining is necessary. It can be tapped from the bottom, which is a great convenience. Thus far the Thermit process has been applied mostly to paved track, but some degree of success has also been attained in its use on exposed track.

L. E. Moore, Boston, pointed out the desirability of educating the public as to the real cost of operating private automobiles in and out of town. Omitting depreciation and other overhead charges, it costs at least 5 cents per mile to go and come from a point 8 miles out of town daily, or 80 cents per diem by automobile, often with a 50-cent garage charge added. For 30 cents round trip a commuter can go and come by rail. It was also brought out that by going into bus operation where conditions warrant it, the electric railway company can apply existing legislative rights of operation to advantage. It was pointed out that a bill in the Massachusetts Legislature compels licensed motor buses to carry school children at half fare, and that this should be opposed by street railways operating buses.

Regulation of Jitneys on Equal Plane with Railways

F. A. Cummings, Boston, and C. Q. Richmond, Pittsfield, urged that licensed motor buses be placed under the same regulative restrictions as electric railways, and that no jitney license should become effective until the department of public utilities had found that public convenience and necessity demand its use. At present jitney licenses from local authorities do not have to be approved by the commission. About twenty-six states now have legislation regulating jitneys through the state public service commissions.

President Hood urged the inclusion of track-mileage data in cost comparison information sent out by the association. He thought the admission of motor bus owners to the association would be helpful to members.

Getting a New Deal from the Public*

By Henry G. Wells
Commissioner Massachusetts Department of Public Utilities

IT IS common knowledge that the public was antagonistic to street railway companies before the war. Of late years, however, the public has cooperated very largely in order that the companies might give reasonable service and receive a fair return therefor. What is the reason for that change of attitude?

In the first place, it would seem that there was very little attempt to cultivate public opinion when everything was running smoothly with the companies. Then came the war. Labor costs and costs of material increased tremendously. The public, with the old instinctive distrust, opposed any increases in rates. The regulatory bodies, because of that popular distrust, were very slow to act until the companies, particularly in this state, were rapidly approaching bankruptcy. Two of the largest roads in Massachusetts were in such condition that radical action had to be taken. Although every one assumed that private ownership of property, with public regulation, was better than governmental control and operation, yet the management of these two roads was placed under public trustees appointed by the Governor. As a result, the public woke up to the necessity of such institutions as street railway companies. They realized that their cost of operation went up as well as everything else, and that service at a higher rate is better than no service at all. During this period more than 400 miles of street railway tracks in Massachusetts were abandoned, and those people who were left without any service realized the mistake of their attitude in the past.

Problem Is to Maintain Public Co-operation

Today the public is more sympathetic to the street railway companies than ever before. Your problem is to maintain that sympathetic co-operation. To do that it is necessary for you to analyze your own condition, to analyze the state of mind of the public with which you deal, to respond to their requests if possible, and, if not, by means of proper publicity to show them why such requests must be denied. Today is a day of readjustment and a critical period in the history of street railway lines. With the present state of the public mind there is no reason why the street railway companies cannot continue to function, give reasonable service and receive a fair return.

Too much must not be taken for granted because of the present condition of the public mind, however, for the peak of high prices has gone by and with every step taken in other lines of activity to reduce prices the public of necessity looks for a reduction in all

*Abstract of a paper presented at a meeting of the New England Street Railway Club, Boston, Mass., Feb. 7, 1924.

things. It must be clearly indicated that street car fares have only increased 45 per cent since before the war, and on a comparative basis there is still a margin between that and other costs. It should be clearly pointed out that the street railway companies have secured their increased fares at a much later date than any one else; and that, therefore, it will be necessary to be slow in readjusting or lowering such fares.

Diversified Service Needed

The street railway used to be considered a monopoly, but that is not true today. The automobile has cut down the revenue of practically every company in the state. No doubt that is why many of the lines have been abandoned, although possibly some of them ought never to have been built. There must be more variety in method of transportation. We have congested centers today where we need subways and tunnels, with trains of six to eight cars, and we have sparsely settled territory where bus lines as a supplement to street railway lines are necessary. So today the service is not all of one kind, and just so far as you men study these conditions and meet these varying changes in conditions, just so much easier it will be to maintain the public mind in a proper attitude.

The use of the one-man car has aided street railway companies in reducing operating costs. There would seem to be room for further use thereof by such companies as are in financial difficulties. Some opposition has been voiced to this type of car. Reliable statistics, not only in our department but gathered all over the country, indicate that these cars are operated, as a rule, more safely than the other types. With that fact established, it would seem that the only question left is whether or not some communities are to have service at all. In other words, there are many lines where the cost is such that one-man cars must be operated or none at all. With the public confronted with the alternative of the one-man car or no car, there would seem to be but one answer.

Bus Can Be Used to Supplement Cars

There are thinly settled territories where even a one-man car does not pay but where a bus, running at reasonable intervals, would serve and would act as a feeder to the rail lines. Jitney competition with street railway companies has not caused as much trouble in Massachusetts as elsewhere and therein, too, the public's attitude has been helpful. All the more reason for street railway companies to study their territory carefully, with a view to utilizing such modes of transportation as are best suited to the territories.

At the other extreme, we have seen recently where a railroad line (the Shawmut Branch of the New York, New Haven & Hartford Railroad) is to be utilized for service by the Boston Elevated Railway. It is possible there are other thickly settled communities where there has been duplicate service by railroad and railway, neither one paying, and where the street railway company could take over the railroad right-of-way, electrify it and operate it in a manner financially satisfactory.

Old Methods Must Be Discarded

In order that the street railway continue with profit as an agency for the distribution of population in order to avoid congestion, and also serve many sparsely settled communities, old methods must be discarded. Just so well as you officials readjust yourselves to these conditions, just so well will you keep the public in a proper frame of mind. Do not assume that the present-day attitude is going to continue. Now is the time to hold it by a little special effort in your relations with the public. Do not assume they are always wrong. Doubtless you have formed the habit of turning down most requests. Even though you did not get the benefit of increased fares as soon as other prices went up, don't assume that anything and everything asked for means too much of a financial burden. Study it carefully from every angle before you decide, and then go over it thoroughly with the applicant, trying to make him understand it from your end.

It may be interesting to know that our principal complaints relate to service, heating (or rather lack of it), and cleanliness of cars. If the scheduled trips are satisfactory, the question of service is eliminated from the primary consideration of the executives. The rest is up to the employees. As to the cleanliness and heating, how much time do the executives spend with the employees on these questions?

Educate Employees and Public

We have spoken of educating the public. Do you educate your employees? No doubt you feel you do spend time enough on such matters with your employees, but you cannot spend too much. The public judges a company by those with whom it comes in contact. The managers may have the best intentions in the world, but that would be easily nullified by those under them. How easy it is for the wrong type of telephone girl to antagonize the party at the other end of the wire. Of course the one calling is more or less "peeved," as a rule, and a little good nature at one end often alleviates the grouch at the other end. Don't answer a written complaint by a mere form letter. Have some one study or investigate and deal with it personally, if possible. It creates better feeling.

Educate the public as well as employees. True, many distrust the paid advertisements of public service corporations. We have seen one company, however, that avoided that by stating that the advertisements were paid for out of the receipts from street car advertising. Tell them facts, not arguments; give them figures easily understandable as to your financial condition, not a mere accountant's report; tell them your difficulties. Do these things regularly, not spasmodically. Do it now, not when conditions change and you want something.

After all, as one official said long ago, real publicity is what you do, not what you say. If the public gets service it is willing to pay for it. If the public is satisfied, it is easier for regulatory bodies to deal fairly and justly with public service corporations. Street railway companies today need the co-operation of their employees and of the public. With that co-operation, regulatory bodies will be relieved of many of their troubles.

Track Bolt Committee Meeting

A MEETING of Sub-Committee No. 4 of the Sectional Committee of the American Engineering Standards Committee, which is dealing with the standardization of track bolts, was held in New York City on Feb. 5. A tentative design together with dimensions for standard track bolts was decided upon, and drawings and specifications will be prepared to be sent out to the various users for their criticisms.

Southwestern Utility Meeting

A JOINT meeting of the Southwestern Public Service Association and the Southwestern Division of the National Electric Light Association will be held in New Orleans April 22 to 25. The subjects will include development of public relations, interconnection of power lines, utility financing and engineering problems.

Utility Secretaries' Conference

ANNOUNCEMENT is made that a conference of secretaries of public utility associations will be held at the Hotel Sherman, Chicago, on March 25.

Illinois Utilities' Joint Meeting

THE annual joint convention of the Illinois State Electric, Gas and Railway Associations will be held March 26 and 27 at the Hotel Sherman, Chicago. A banquet will be given on the evening of March 26.

I.B.A. Public Service Committee

AMONG the committees appointed by President J. W. Prentiss of the Investment Bankers' Association of America is one on public utilities, with the following personnel:

Henry R. Hayes, Stone & Webster, Inc., New York, chairman; Eli T. Watson, Watson, Williams & Company, New Orleans, vice-chairman; James C. Willson, Louisville; Chester Corey, Chicago; Charles R. Blyth, San Francisco; Russell D. Bell, Montreal; C. J. Waddell, Philadelphia; John Esmond, Chicago; H. M. Addinsell, New York; Edgar C. Rust, Boston.

Day & Zimmermann Auditors Organize

AT A meeting in Philadelphia the auditors of the various properties managed by Day & Zimmermann, Inc., organized an association known as the Day & Zimmermann Auditors' Association. Officers elected were Melvin A. Miller, auditor Penn Central Light & Power Company, Altoona, Pa., president; W. C. Schoeppe, Alexandria, Va., vice-president, and L. W. Van Bibber, Springfield, Ohio, secretary and treasurer.

The News of the Industry

Akron Growing Restive

Public Sentiment Is Strongly Against Avowed Nickel-or-Nothing Policy of Mayor Rybolt

Following an injunction issued by Judge C. H. Wood, on application of the Jitney Bus Owners' Association to prevent the operation of buses from outside points in Akron until they comply with the jitney ordinance, Mayor D. C. Rybolt announced that bus operation would not stop and that the court order would "make no difference in bus operation." The city, however, discharged practically all of its bus starters and they were later all hired by bus operators.

The Mayor announced on Feb. 14 that he would have a bus ordinance providing a straight 5-cent fare introduced at a special Council meeting held on Feb. 15 and that the Council would be asked to grant bus operators the right to run for a period of one or two years.

At a meeting of the City Council on Feb. 12 the Merchants' Association, the Chamber of Commerce, the Clearing House Association and various other organizations presented petitions to the Council asking the restoration of cars at a 6-cent fare for such period as was necessary to secure and submit to the people a permanent franchise for the operation of street cars and buses by the Northern Ohio Traction & Light Company.

Widespread Demand for Settlement

The City Hall was stormed with citizens who demanded that the cars be put back into service; several hundred persons were unable to get into the Council chamber. Resolutions presented at this meeting declared the existing conditions to be intolerable. The city claims to have 120 buses in operation, but checks which have been made by the railway and other interests show that the maximum number operated was sixty-nine. The service is practically no better than it was early in the month. Thousands of people are still walking to and from their work and in many instances workers are paying from 10 to 15 cents bus fare.

Edward S. Rose, Councilman from the Sixth Ward, has submitted an ordinance providing for a million dollar bond issue by the city for the purpose of having the municipality establish a bus system.

Merchants and other business men are still suffering from a decrease in business and advertising in the local newspapers has been cut 30 to 40 per cent.

Thousands of telephone calls are coming into the city and to the newspapers urging that the cars be put back into service, while all newspapers are carrying many letters dealing with the subject. Most of these letters insist that the car service and the bus service of the Northern Ohio Traction & Light Company be restored. Very few of the letters indorse the Mayor in his effort completely to motorize the city.

No modern buses are being operated. Buses are in Akron, however, from New Jersey, Michigan, various towns throughout Ohio, Indiana and some from Illinois.

Terrific pressure is still being brought upon the Council by the general public to recede from its "nickel-or-nothing" policy and grant the railway a 6-cent fare with transfers.

Arguments were heard on Feb. 15 on the injunction to prohibit the fifty outside buses from operating unless they comply with the law. Reports that day were to the effect that some of the eight members of the City Council who have been supporting the scheme for complete motorization are becoming dissatisfied with the Mayor's failure to make good his pledges to furnish Akron the finest bus transportation system in the world. The proposal now is to pass a blanket bus franchise to no particular persons, fixing a 5-cent fare, and try to get companies to operate under it.

Transit Report Under Way at Boston

The report of the Metropolitan Planning Division, at Boston, created by last year's Legislature, has been filed at the State House. The division, which is part of the Metropolitan District Commission, was authorized to make recommendations as to the general transportation service and facilities in Boston and vicinity.

The report deals with three features of the general proposition: Transportation on the highways, by street railway lines, and the relation between railroad facilities and the steamship systems centering in the port of Boston.

In the matter of street railways the opinion is expressed that the carrying capacity of the existing subways in Boston can be doubled by making changes in the construction of platforms and by making other changes in construction.

Further the report says that where existing railroad tracks cannot themselves be utilized by the Boston Elevated Railway because of the need of steam railroads, it is entirely possible that elevated service can be carried on surface tracks parallel to the steam tracks.

The board says that it hopes during the coming year to prepare a comprehensive report dealing with the present facilities of the Boston Elevated and needed enlargements and extensions.

Interstate Will Pay Pensions

Funds Are to Be Administered by Joint Board, Representing Both Company and Employees

Establishment of a service annuity plan for pensioning employees who have completed a certain period of service, was recently announced by the Interstate Public Service Company, Indianapolis. In general the retirement of men employees is at the age of sixty-five and of women employees at the age of sixty, but under certain conditions men employees may retire at the age of sixty and women employees at the age of fifty-five. All costs of the plan will be defrayed by the company. Administration will be by a board of five trustees, three of whom will be chosen annually by the board of directors from among the officers or employees of the company, and two elected annually by the employees from their own number.

Retirement on pension is obligatory for men employees at the age of sixty-five and women employees at the age of sixty, unless the board of directors, for special reasons continue the employee in active service without a service annuity. The rate in each case is 2 per cent of the average annual salary of the employee for the period of continuous service to the date of retirement, multiplied by the number of years of such service with the company, but the amount is not to exceed 50 per cent of the final annual salary or be more than $6,000 per annum. Employees now in the service of the company and over the retiring age are to have their annuities computed on the number of years of service and thereafter have the same standing as at the retiring age.

Plan Now in Effect

There is a provision by which the man employee who has reached the age of sixty while in service or a woman employee the age of fifty-five may be retired upon annuity upon his request or a request of his superior, if approved by the trustees, if he or she has been in the service of the company continuously for twenty years or more. In this case, the amount of annuity is determined by a sliding scale. Thus, the pension of a man at sixty years is 1.5 per cent of his average salary times the years of service, with a maximum of forty per cent of his final salary, and at sixty-four years the percentages are 1.9 and forty-eight respectively. Similar figures hold for women employees from fifty-five to fifty-nine years of age.

The pension plan was announced by special order dated Dec. 28, 1923. It was signed by Harry Reid, president, and went into effect Jan. 1, 1924, as noted previously in this paper.

Arbitration Suggested

Traction Company and Street Railway Are Unable to Agree on Reorganization

Arbitration of the differences between the Cincinnati Traction Company and the Cincinnati Street Railway was suggested after representatives of the companies reported to the street railroad committee of the Council of Cincinnati on Feb. 11 that they were unable to agree on plans for a reorganization of the electric railway system of Cincinnati. City officials, as well as members of the Mayor's traction committee and representatives of the Cincinnati Street Railway, expressed opposition to the arbitration feature, which was suggested by W. Kesley Schoepf, president of the Cincinnati Traction Company, in a statement read to the committee by Walter Draper, vice-president.

Mayor George P. Carrel urged the committee to recommend to the City Council that the city solicitor be empowered to proceed immediately to protect the city and the public. The committee took the suggestions of Mayor Carrel and Mr. Schoepf, together with the statements of the companies, under advisement. It is possible that the committee will call the companies together for a final attempt to bring about an amicable settlement before making its report to City Council.

FUTURE ACTION UP TO COMMITTEE

What action the city will take in the matter depends entirely on the recommendations which the street railroad committee will make. The city solicitor, it was said, can bring suit asking for a receiver for the Cincinnati Traction Company or the city can institute legal proceedings against the traction and street railway companies to abrogate the service-at-cost franchise. Regarding the latter procedure, it was indicated that it would involve years of litigation and much expense to the public, as the Cincinnati Traction Company could take the matter into the United States courts because it has stockholders outside of Ohio.

While the street railway company is willing to offer $3,000,000 in its capital stock and other considerations for the return of the traction system, W. Kesley Schoepf, president of the traction company, said that the minimum his company would accept was $6,000,000 in stock, although he was willing to arbitrate the matter. Mr. Hinsch and Mr. Dupuis offered Mr. Schoepf $4,250,000 of the street railway's stock, which he also turned down.

Robert A. Taft, who, with Samuel Assur, represented the street railway at the meeting, informed the committee that there was nothing to arbitrate in view of the fact that his company in submitting its offer for return of the system based its conclusions on the earning power of the system. Mr. Taft further said the street railway company's offer involved the purchase of the leasehold interest of the Cincinnati Traction Company and the Ohio Traction Company in the street railway properties for $7,468,328. In addition, he said the railway company would give the traction company the buildings and ground now occupied by the Cincinnati Car Company and a reasonable amount of the ground now occupied by the Chester Park Amusement Company. The car plant and the ground occupied by the amusement company were leased, together with the traction system, by the street railway company to the traction company in 1901 for a period of forty-five years.

The street railway company, according to its offer, proposes to pay the $7,468,328 as follows: Assuming and paying as of Jan. 1, 1924, first mortgage bonds of the Ohio Traction Company of $1,570,000; $600,000 face amount of notes of the Ohio Traction Company due on Oct. 1, 1924, and $647,328 of additions and betterments not funded; assume and pay as they come due, $1,651,000 face amount of the car equipment notes of the Cincinnati Traction Company. The foregoing items represent debts of the Ohio Traction and the Cincinnati Traction companies. In addition the street railway company will bring the traction company $3,000,000 in par value, or 60,000 of its new shares of capital stock.

Committee Appointed to Study Subways for Pittsburgh

After a conference with Mayor William A. Magee of Pittsburgh, members of two planning bodies and representatives of the Philadelphia Company, the City Council of Pittsburgh voted on Feb. 1 to leave downtown subway and rapid transit matters for the present in the hands of a committee composed of Arthur W. Thompson, president of the Philadelphia Company and also head of the Pittsburgh Railways; Director Charles A. Finley of the city's Department of Public Works; Morris Knowles, chairman of the City Planning Commission; George S. Davison, member of the same commission, and Winters Haydock, chief engineer of the Citizens Committee on City Plan.

The committee of five was instructed to "study, investigate and report at an early date on the matter of a subway and all incidental matters pertaining thereto, and to report whether an expert engineer should be employed to study these matters."

Agreement on Bus Operation

The Eastern Massachusetts Street Railway has an agreement with the town of North Reading, Mass., by which the town will pay the company $1,100 for the year 1924 to cover the cost of operating a bus line from North Reading Junction to North Reading Center dating from Jan. 6. It is estimated that the traffic revenue will come within this sum of paying the cost of the service for a year. The company operated a railway line to North Reading up to Jan. 6, but the trustees did not feel that the traffic on the line warranted rebuilding it. The townspeople agreed to contribute to the cost of operating a bus line. The regular cash fare of 10 cents is charged.

Construction of 60,000 Kw. Power Plant at Detroit to Proceed

The city of Detroit will start immediately to build a 60,000-kw. power plant to furnish power for the Detroit Department of Street Railways. Together with transmission lines, substations and distribution appurtenances the estimated cost will be $11,611,000. The decision to proceed at once with the three-unit plant will result in the reduction from the originally planned four-unit plant with 80,000 kw. capacity at an estimated temporary saving of $2,000,000 in cost. This it is believed will enable the plant to be built within the $12,000,000 bond issue voted last April. It is expected that the plant will be ready to operate by Oct. 1, 1926.

It is the opinion of the officials that the existing interim contract with the Detroit Edison Company should be canceled and a new contract be drawn in accordance with the tentative proposal submitted to the acting Mayor under date of Jan. 28, 1924. The proposal as submitted is verbally revised to the extent that the Detroit Edison Company agrees to the original terms based on a minimum sale of 110,000,000 kw.-hr. a year, with the exception of the two tapering-off years. It is estimated the new Edison arrangement will save the Detroit street railways $1,250,000 between Jan. 1, 1924 and Oct. 1, 1926.

The city's present needs are placed at approximately 240,000,000 kw.-hr. a year. The estimated output of the proposed new three-unit plant is 300,000,000 kw.-hr., and a fourth turbo unit may be added at any time. The first year's construction program will be financed by the sale of $1,000,000 of public utility bonds. Steps will be taken at once to obtain the approval of the Public Utilities Commission for the proposed interim contract and to place the first $1,000,000 of bonds on the market.

Wages Increased Four Cents

An increase of 4 cents an hour has been granted the trainmen employed by the Middlesex & Boston Street Railway, Newtonville, Mass., according to the award handed down recently by the board of arbitration. The award is retroactive to July 1, 1923, and will continue in force until June 30 of this year. The men were receiving 51 cents an hour and the increase brings the maximum wage for them to 55 cents an hour.

The wage question was one of six disputed points referred to the board of arbitration and was the only one on which the board found for the men. The demands for increasing the existing differential rate for operators of one-man cars to more than 5 cents an hour were rejected, as were requests for increased compensation for snow work, overtime pay for the miscellaneous men, and a reduction in working hours for carhouse men and miscellaneous men employed by the railway from nine hours in ten consecutive hours to eight hours in nine.

The board also rejected a request for a change in hours for platform work.

Work to Begin on $900,000 Improvement Program

Th Houston Electric Company, having won its fight against the use of jitneys, as noted in the ELECTRIC RAILWAY JOURNAL for Jan. 26, is preparing to carry out the conditions of the agreement reached by it with a committee of citizens.

On its part the railway company agreed:

To abandon its suit for an increased fare.
To route its lines in accordance with the Beeler plan.
To construct 4,200 ft. of single track, and 15,100 ft. of double track.
To speed up service.
To buy additional rolling stock and remodel present equipment.
To establish and maintain a bus line to the section south of McGowen Avenue and Crawford Street and extend it to Southmore as street pavements are completed.
To spend $900,000 in the next three years on additional improvements not outlined above, such as the extension of present car lines and the establishment of new street car and bus lines to serve every part of the city.
To pay the cost of paving between tracks without contest.

The city agrees to these conditions:

To abolish jitneys.
To hire a consulting engineer to check improvements and extensions.

Both the city and the company agree to drop the injunction suit in the federal court in which the company sought a higher fare.

Public Relations Department Will Sell Service in Dallas

"Merchandising Service" is the central idea of the work of the public relations department recently created by the Dallas Railway, with C. J. Crampton, formerly superintendent of the safety and efficiency department, in charge. The department of safety and efficiency has been abolished and the safety work heretofore carried on by Mr. Crampton has been turned back to the operating department. This is in line with the company's policy of making safety a part of the job of every employee of the company and not an activity to be carried on by a separate department.

In the conduct of the department of public relations Mr. Crampton will employ newspaper advertising, street car advertising, billboard and screen advertising, newspaper publicity and will co-operate with the various civic and other organizations in the city, such as luncheon clubs, the Dallas Safety Council, mothers' clubs in the public schools, etc., and "sell street railway service, street railway good will and street railway transportation wherever he can."

More than $2,000,000 for Detroit Improvements

A tentative program announced by the Department of Street Railways of the city of Detroit includes extensions, improvements and rehabilitation of street railway lines and equipment estimated to cost between $1,250,000 and $2,000,000. It is planned to commence the work in the spring and it is estimated that the extension program will take about two years to complete. It is planned by the commission to spend such amount of money as is made available out of the $5,000,000 bond issue voted by the electors of Detroit last April, and at the same time continue financing its rehabilitation program from the earnings of the system. As approximately $900,000 is available annually for rehabilitation purposes, the total to be spent during the next two years, including amounts from bond sales and earnings, will approximate $3,000,000.

Twelve new lines or extensions are proposed, the most of which will be extensions into new city territory not now served by the street railway lines. Plans for the track extensions have been completed and only the Mayor's and the commission's approval are needed.

Arbitration of Wage Increase Demanded in Atlanta

Local No. 732 of the Amalgamated Association has demanded arbitration of its request to the Georgia Railway & Power Company, Atlanta, for an increase of 25 per cent in the wages of trainmen in the employ of the company. The contract between the company and its men covering wages and working conditions expired on Dec. 31, 1923. When the request of the men was presented to the company it in turn submitted its financial statement to the union, showing that it was already losing money in operating its street cars and stated that it could not consider any increase in wages until additional income could be secured.

This made little or no impression upon the employees. They have insisted upon arbitration under the terms of the contract. C. Murphy Candler has been selected by the power company as its arbiter in the increased wage demand. The union has not yet selected its arbiter.

Articulated Car Goes to Detroit

The three-unit articulated car which is being built for the Detroit city lines at the Cincinnati Car Works will leave for Detroit Feb. 19 under its own power and will travel to Detroit over connecting interurban lines. It is scheduled to reach Dayton at noon and Lima at 5 p.m. on Tuesday. It will leave Lima at 8 a.m. Wednesday, arrive at Toledo at noon and Detroit 4 p.m. the same day.

The articulated unit has a length over all of 121 ft. and a seating capacity for 132 passengers.

Will Confer on Situation.—The Mobile Light & Railroad Company has requested the members of the Alabama Public Service Commission to visit Mobile and go over the railway situation with officials of the company. Recently the company asked the permission of the City Commissioners to discontinue its Michigan Avenue and Wilkinson Street lines. The company also asked of the city commission the right to extend certain lines.

Bill Reported Unfavorably.—A bill offered in the Maryland General Assembly providing that separate electric railway cars be furnished for white persons and negroes has been reported unfavorably by the committee and the unfavorable report adopted by the House of Delegates.

Files Protest Over Paving.—Protest has been filed by Madison Railways, Madison, Wis., with Council in connection with a bill received from the city requesting payment of the company's share of the expense in excavation work completed in the railway zone on East Johnson Street. Dudley Montgomery, vice-president of the company, pointed out that a contract entered into between the city and his company on May 9, 1923, provides that the company is released from such obligations. The city maintains, however, that under the terms of the contract the company is bound to pay the entire excavation cost.

Two Resolutions Affect Baltimore Company.—The United Railways & Electric Company, Baltimore, has been made the target of two resolutions introduced in the Maryland General Assembly in session at Annapolis. One would authorize and direct the Public Service Commission to force the company to man all its cars with motormen and conductors and is a move against the one-man cars now used on some of the lines. The other would prohibit the collection of more than one fare within the limits of the city.

"Hail Columbia" New Magazine.—"Hail Columbia," a new magazine published by the Columbia Gas & Electric Company, described as "a monthly publication through whose pages the employees and friends of the Columbia Gas & Electric Company may obtain a broad view of its aims and accomplishments and become better acquainted with the underlying principles on which the company was founded," has published its first number, dated January, 1924. The opening issue contains a foreword by P. G. Gossler, president of the company, announcing the inception by Columbia of a customer-ownership policy. A map entitled "The Land of Columbia" shows the territory served by the Columbia operating companies. Among the properties which the company controls is the Cincinnati, Newport & Covington Light & Traction Company.

Other Dynamiters Are Indicted.—William H. Smith, Jr., who is under sentence of one year in the Erie County penitentiary and a fine of $3,000 for conspiracy in connection with the dynamite outrage at Ellwood, N. Y., during the International Railway strike in August, 1922, has been indicted by the Niagara County grand jury on charges of grand larceny and burglary for the alleged theft of quantities of dynamite on Aug. 14, 1922, three days before the railway explosion. He pleaded not guilty when arraigned in County Court at Lockport and was held under $10,000 bail for trial. Smith is now on bail pending an appeal to the United States Circuit Court of Appeals from the Federal court conviction for alleged conspiracy to violate the Sherman anti-trust law for alleged interference with interstate traffic. William VanDell, Lockport, a former employee, has been indicted by the county grand jury on similar charges.

Financial and Corporate

$679,632 Gain for Boston Elevated

Road Has Largest Year in Points of Gross Receipts and Passengers Carried—Increased Labor Costs a Burden, but Public Trustees Look Hopefully Toward Future

THE year 1923 was the largest in points of gross receipts and passengers carried in the experience of the Boston Elevated Railway. It was the fifth calendar year of public operation. There was a gain of $679,632 for the year, compared with $1,412,189 for 1922.

Owing to the increase in labor costs that followed the arbitration award of October, which was retroactive to July 1, 1923, the cost of service during the last six months of the year showed a substantial increase. In fact, the increase in wages made it necessary to call upon the reserve fund to help meet the cost of service. On Jan. 1, 1924, the balance in the reserve fund was $624,889.

In July, 1923, the trustees turned over to the Commonwealth $1,114,557 for distribution to the cities and towns which contributed to the loan assessment to meet the deficit of the first year of public operation. There remains a balance of $2,348,397 still due to the municipalities on this loan.

The average receipts per passenger for the year were 8.923 cents. The allocation of the receipts is shown in one of the accompanying tables.

As far as operating cost and operating revenue are concerned, the public trustees say it may be safely predicted that at the end of the year which will close on June 30, 1924, it should be found that receipts have at least been equal to expenditures so that there should be no deficit to assess on cities and towns served. This result is expected despite the fact that the increase in wages during the past year will add approximately $2,500,000 to the labor cost for the year ended June 30, 1924, on more than twice the excess of revenue over the cost of service for the preceding year. As the trustees see it, the answer to the question is that unusual freedom from expense in the removal of snow has continued so long as seemingly to assure a small rather than a large expense for the entire season.

Another reason for the faith of the trustees is their belief in the continuance of the increased traffic which has made the past calendar year a record breaking one in the number of passengers carried. This increase marks the practical restoration of traffic lost at first under the 10-cent fare, a restoration due in large part to the introduction of 5-cent fare lines that are now carrying more than one-quarter of the traffic. Another thing, the results are beginning to be shown in a really appreciable way of economies long in preparation. As a specific instance it is pointed out that through the introduction of modern boilers at South Boston, as well as the introduction of new light-weight cars—notwithstanding an increase of 3,474,577 miles and of 25,555,755 passengers carried—13,409 fewer tons of coal were burned than last year. After all, however, the trustees say it must remain true that whatever compensating factors may be found, the increased cost of labor will inevitably tend to check the development of additional 5-cent fare lines and improvements in service, and will delay the reimbursement of cities and towns.

The trustees are cognizant of the need of extensions of the rapid transit system to meet the demands of heavy traffic, and they refer to specific improvements of intimate interest to

STATEMENT OF TOTAL REVENUE PASSENGERS CARRIED BY THE BOSTON ELEVATED RAILWAY

1923	382,149,697
1922	356,593,942
1921	337,252,080
1920	335,526,561
1919	324,758,685
1918	348,664,700
1917	381,017,338
1916	373,577,908
1915	352,469,586

ALLOCATION OF RECEIPTS PER PASSENGER OF THE BOSTON ELEVATED RAILWAY IN 1923

	Cents
Labor	4.246
Interest on bonds and notes	0.606
Rent of subways and tunnels	0.530
Rent of based roads	0.834
Coal	0.482
Depreciation	0.524
Damages	0.215
Material and other items	0.866
Taxes	0.442
Total	8.745
Excess of receipts over cost of service	0.178
Average receipts per revenue passenger	8.923

REVENUE RIDES PER CAPITA ON BOSTON ELEVATED RAILWAY

1923	320
1918	300
1913	298
1908	277
1903	262

COMPARATIVE DIVISION OF RECEIPTS AND EXPENDITURES OF BOSTON ELEVATED RAILWAY FOR YEAR ENDED DEC. 31.

	1923	1922	1921	1920	1919
Total receipts	$34,096,813	$32,699,176	$33,277,025	$34,031,636	$29,498,583
Operating expenses:					
Wages	$16,224,277	$14,772,341	$15,563,255	$17,216,445	$15,539,105
Material and supplies	3,236,805	2,903,650	3,093,934	3,310,858	3,640,065
Injuries and damages	822,775	555,355	518,249	640,165	701,907
Depreciation	2,004,000	2,004,000	2,004,000	2,004,000	2,004,000
Fuel	1,842,396	1,853,112	1,663,618	2,597,654	1,815,262
Total operating expenses	$24,130,253	$22,088,458	$22,843,056	$25,769,122	$23,700,339
Taxes	1,688,139	1,587,186	1,546,758	1,142,987	1,045,502
Rent of leased roads (including dividend rental under chapter 159, Acts of 1918)	3,185,577	3,646,595	4,203,064	4,102,230	4,002,656
Subway and tunnel rents	2,026,936	2,008,417	1,963,737	1,790,432	1,516,047
Interest on bonds and notes	2,316,029	1,891,315	1,494,258	1,514,963	1,555,790
Miscellaneous items	70,247	65,016	54,707	59,069	60,348
Total cost of service	$33,417,181	$31,286,987	$32,105,580	$34,378,803	$31,880,682
Loss for year	.....	.....	.....	$347,167	$2,382,099
Gain for year	$679,632	$1,412,189	$1,171,445	.....	.....

Profit and loss items not included in above.

TRAFFIC STATISTICS OF THE BOSTON ELEVATED RAILWAY FOR YEAR ENDED DEC. 31.

	1923	1922	1921	1920
Round trips operated	6,488,082	6,059,531	5,773,584	5,764,347
Passenger revenue	$33,297,951.50	$31,834,022.77	$32,253,629.59	$33,108,946.48
Passenger revenue per car-mile (cents)	61.61	62.94	64.89	64.62
Passenger revenue per car-hour	$5.71*	$7.09	$7.36	$7.16
Passenger revenue mileage	54,049,665†	50,575,088	49,706,697	51,237,527
Passenger revenue car-hours	5,826,993*	4,487,400	4,381,815	4,627,295
Revenue passengers carried	382,149,697	356,593,942	337,252,080	335,526,561
Revenue passengers carried per car-mile	7.070	7.051	6.785	6.548
Revenue passengers carried per car-mile	65.58*	79.47	76.97	72.51

* Car-hours, American Electric Railway Association Standard, adopted Feb. 1, 1923. † Including motor bus mileage 465,382.

COMPARATIVE POWER STATION STATISTICS OF THE BOSTON ELEVATED RAILWAY

	1923	1922	1921	1920	1919	1918	1917
Tons of coal burned	260,032	273,441	215,870	258,087	287,670	281,677	270,452
Pounds of coal per kilowatt-hour	2.264	2.553	2.174	2.353	2.835	2.772	2.309
Average price of coal per ton	$7,085	$6,777	$7.71	$10.07	$5.91	$6.26	$4.19
Net cost of power for car service per kilo-watt-hour (cents)	1.227	1.414	1.172	1.921	1.307	1.158	.620
Net cost of power per total revenue car-mile (cents)	5.468	6.153	4.815	8.538	5.439	4.668	2.573
Direct current annual output (kilowatts)	257,270,357	239,905,874	222,461,060	245,676,503	239,892,118	227,582,057	262,343,882
Direct current maximum hour output (kilowatts)	82,965	78,755	75,905	72,295	71,760	67,965	79,535

HISTORY OF THE 1919 LOAN ASSESSMENT ON CITIES AND TOWNS (CHAPTER 159, SPECIAL ACTS OF 1918)

Allocation of Assessment on Cities and Towns of Boston Elevated Deficit, Year ended June 30, 1919.

Cities and Towns	Passengers	Per Cent	Amount of Assessment	Distribution of July, 1922, Repayment	Distribution of July, 1923, Repayment	Balance Due
Boston	2,100,423	71.9330	$2,863,042	$372,034	$790,029	$1,700,978
Cambridge	283,475	9.7081	386,397	50,209	106,622	229,564
Somerville	122,583	4.1981	167,090	21,712	46,106	99,271
Brookline	74,553	2.5532	101,621	13,205	28,040	60,375
Medford	59,754	2.0464	81,449	10,583	22,475	48,390
Malden	55,838	1.9123	76,112	9,890	21,002	45,219
Everett	54,823	1.8775	74,727	9,710	20,619	44,397
Watertown	41,198	1.4109	56,155	7,297	15,496	33,367
Arlington	32,477	1.1122	44,267	5,752	12,215	26,299
Chelsea	29,659	1.0157	40,426	5,253	11,154	24,018
Newton	27,201	.9316	37,079	4,818	10,231	22,029
Belmont	18,746	.6420	25,552	3,320	7,058	15,180
Quincy (Commonwealth of Massachusetts)	15,569	.5332	21,227	2,757	18,464	.....
Stoneham (Commonwealth of Massachusetts)	3,674	.1258	5,007	656	4,356	.....
Commonwealth of Massachusetts*	.....	.....	.....	.....	690	†690
Totals	2,919,973	100.00	$3,980,151	$517,196	$1,114,557	$2,348,397

Based on traffic counts made July 24, 25, 26, 27, 1919, in accordance with the provisions of section 14, chapter 159, Special Acts of 1918.

* From the July, 1923, repayment the Commonwealth of Massachusetts deducted $690.24 to reimburse themselves for the difference between 126 days' interest at 4.28 per cent on $4,000,000 (note issued July 17, 1919, due November 20, 1919) and $3,980,151.67, the amount paid to the Boston Elevated Railway Company $297
And interest from July 17, 1919, to July 19, 1923, on amount the State deducted to pay assessment of Quincy and Stoneham 393

Amount of expense to State to be assessed to towns and cities pro rata to their original contribution $690

† Credit.

Boston that should be carried out. In this connection they look forward hopefully to the report of the Metropolitan Planning Board and to the adoption of a comprehensive plan for the orderly and consistent development of separate trunk lines to provide a harmonious and well devised system of transportation for Boston and suburban cities and towns. The trustees see money at hand as needed at lowest prices for subways, tunnels and permanent structures through municipal investment, to be repaid in rentals by the operating lessee, but immediately in the foreground they see the outstanding need for capital for the purchase of additional cars, for enlarged power and shop facilities, and other equipment. To carry out these last-mentioned improvements additional capital can only be procured by the sale of securities of the Boston Elevated Railway, either in the form of stocks or bonds. At the time of the passage of the public control act in 1918 it was believed that the dividend rate of 6 per cent assured it would be possible to issue new stock and obtain new capital in that way, but such has not been the case. On this point the trustees say:

> Quite likely this is due in part to the indefiniteness of the period of public control which under Chapter 159 of the special acts of 1918 continues until 1928, and thereafter until terminated by act of the Legislature. The investor does not know what action the Legislature may take, and consequently this stock does not hold the position which certainty of return would produce. This element of doubt also adversely affects the marketing of long-term bonds.

Astoria System Offered for Sale

The electric railway system of the Pacific Power & Light Company, operating in Astoria, Ore., has been offered to the city, the port commission or any interested party who will operate it, for the salvage price of $70,000. The valuation placed on the system by the State Tax Commission was $262,000.

The company has notified the city that it would suspend operations on March 1 and Guy W. Talbot, president, advised the city officials at a recent conference that it was impossible for the company to change its plans. He states that the railway has lost money for several years, and that an investment of $110,000 would be necessary to restore the system through the area burned in the big fire that practically destroyed the city a year ago.

Mr. Talbot stated that as a result of the inroads in the railway business by buses and privately owned cars the line was wholly incapable of operating at a profit. He said that in 1923 the net loss was $42,718. The loss in 1922 was $33,500; in 1921. $36.500; in 1920, $17,000 and in 1919, $23,000.

At the same time the City Manager of Astoria recommended that the city advertise for bids for a franchise to operate an intracity bus system. The commission has since voted unanimously to empower the manager to secure such bids.

Merger in New Jersey a Possibility

A merger bill has been introduced in the Legislature of New Jersey, designed to facilitate future financing of utility development. The bill is in the interest of the Public Service Corporation of New Jersey, but it has been explained that it is quite possible the merger enabling act may never be made use of by the Public Service. In view of the facts, however, that the time for introducing bills without unanimous consent was expiring, and that the Legislature would shortly adjourn for another year, it was deemed wise to have the merger bill introduced so that, if passed, necessary legal machinery required for this particular plan would be available. Other plans under consideration require no change in existing law.

On behalf of the company it has been explained that the Public Service group has reached a point in its continuing development which makes its financial requirements approximately $20,000,000 a year. The outlook is that the demand for increasing utility services, to keep pace with population and industrial growth, will make similar requirements an annual necessity for some time to come. A number of plans designed to meet this financial prospect have been discussed, but none of these possible plans has yet been completed in detail, and the merger plan is merely one of those under consideration, because of its ability to provide a broader supporting basis for future financing.

Interest Defaulted by Michigan Interurban

The Grand Rapids, Holland & Chicago Railway, Holland, Mich., operating between Grand Rapids, Holland and Macatawa Park, defaulted in the payment of interest on its bonds due on Feb. 1 and a committee headed by Steward Hanley, Detroit, as chairman, has been appointed to protect the interests of the bondholders.

There are $1,475,000 of first mortgage twenty-year bonds outstanding. They were extended at 7 per cent to Aug. 1, 1924.

It is explained that the position of the company was affected among other things by the decision of the Michigan Supreme Court, dated Dec. 19, 1923, requiring the company to pave between its tracks running through the village of Grandville, involving the expenditure of approximately $70,000 by May 1, 1924, or forfeit its franchise.

Separation of Railway and Light Properties Approved

The meeting of stockholders of the Commonwealth Power Corporation has been held, the organization of the Electric Railway Securities Company has been effected and the transfer of the assets of the Commonwealth Power, Railway & Light Company has been made. The last-mentioned company is now prepared to distribute to holders of its common stock one share of Commonwealth Power Corporation common stock and one-half share of Electric Railway Securities Company capital stock for each share of common stock of Commonwealth Power, Railway & Light Company surrendered for cancellation.

As explained previously in the ELECTRIC RAILWAY JOURNAL the plan contemplates the segregation of the former railway and the electric light and power properties of the Commonwealth Power, Railway & Light Company.

The Electric Railway Securities Company either directly or through the Union Railway, Gas & Electric Company, by ownership of stock of the companies, will control the Grand Rapids Railway, the Michigan Electric Railway, the Michigan Railroad, the Grand Rapids, Holland & Chicago Railway, the Saginaw Transit Company, the Rockford & Interurban Railway and the Janesville Traction Company. These companies have outstanding stocks and bonds to the amount of $52,361,596, of which $24,422,603 are owned

by the Electric Railway Securities Company.

An initial dividend of $1 a share has been declared on the common stock of the Commonwealth Power Corporation for the quarter ending April 30, 1924.

Detroit Commission Will Revise Purchase Contract

The City Street Railway Commission of Detroit is working upon a plan of revising the purchase contract covering the lines now included in the municipal railway, so that the period of payment can be spread over a longer period of time, thereby making available more of the earnings of the Detroit Street Railways for improvements of all kinds.

Ross Schram, assistant general manager, calls attention to the large amount that must be set aside as charges necessary to repay the original $15,000,000 bond issue and take care of the purchase of the D. U. R. system over a ten-year period. Approximately 9 cents from every car-mile operated is required to meet these fixed charges, he stated. The actual cost of operating a car-mile is approximately 32 cents. Adding to this 9 cents for fixed charges makes it necessary for each car operating one mile over the system to earn a fraction more than 41 cents, while the average earnings per car-mile is 43.7 cents.

It is further pointed out that the system is operating upon the second lowest fare in any large city in the United States, while it is paying the second highest rate of wages to its platform employees.

State Body Asked to Approve Brooklyn Stock Increase

The Brooklyn City Railroad has applied to the New York Transit Commission for approval of the issuance of $4,000,000 in additional capital stock of the company, to cover the purchases of rolling stock made on its behalf by the Brooklyn City Development Corporation.

In its petition the railway states that it made expenditures from earnings in excess of $4,900,000 consisting of $500,000 on track and roadway, $150,000 for converting and improving the cars and $4,260,000 in the purchase of the capital stock of the Brooklyn City Development Corporation. The latter corporation has used the sum so realized, the petition states, in the purchase of additional cars.

The petition further says that in connection with the addition of the new capital stock to the existing securities of the Brooklyn City Railroad, it will dissolve the Brooklyn City Development Corporation and have transferred to it the rolling stock purchased by that company. The new shares will be divided pro rata among the shareholders of the Brooklyn City Railroad if the issue of the $4,000,000 requested is approved by the commission.

The commission has fixed Feb. 18 as the date for a hearing upon the petition.

As announced previously in the ELECTRIC RAILWAY JOURNAL, the stockholders have already approved the proposal to issue the additional stock.

Amendment to End Tax-Exempt Issues Fails

The constitutional amendment designed to stop the issuance of tax-exempt securities failed in the House on Feb. 8 because it lacked seven votes of the necessary two-thirds.

Passage of the amendment was asked by President Coolidge and Secretary Mellon. Most of the votes against it came from the Democratic side of the House, but eighteen Republicans voted "no," while sixty-nine Democrats voted in the affirmative. The chief argument of the opposition was that state rights would be invaded.

$1,250,000 to Montreal Tramway for Terminal Section

Sale of the Montreal Terminal Section of the Montreal Tramways system is authorized in a bill which passed the private bills committee of the Legislative Assembly on Jan. 31. The company cannot sell any portion of its system without an amendment to the contract between the company and the city. It was explained that there was no intention of depriving the district at present served by the line of service, and that the new line necessary would be built before the sale was effected and the line turned over.

The tramway will receive $1,250,000 for the line from the Canadian National Railways, which needs another outlet to the eastern end of the Island of Montreal. The money which the tramway will receive for the line will either go to building the new track needed, or, if not needed for capital expenditures, will go into one of the various funds.

Auction Sales in New York.—At the public auction rooms of A. H. Muller & Sons there were no sales of electric railway securities this week.

Wants to Abandon.—The Pennsylvania & Ohio Traction Company of Ashtabula recently petitioned the State Public Utilities Commission for authority to abandon its service connecting Conneaut, Ashtabula and Jefferson, Ohio.

Officers Elected for Successor Road.—The first meeting of the new Gardner-Templeton Street Railway was held on Feb. 5. Officers were elected as follows: Charles Mulhado, president; Edgar A. Shepardson, vice-president, and Ralph Kelly, secretary and treasurer. Louis Starkey has been named superintendent of the line. The company took over control of the line on Feb. 7.

Conditional Suspension Authorized.—The San Diego Electric Railway has been authorized to suspend service and to abandon and remove its tracks and appurtenances on the so-called Old Town line in San Diego, Cal., conditional upon the establishment of regular bus service. The company is also authorized to suspend service and to remove the tracks on the so-called Ocean Beach line between the intersection of Rosecrans and MacAulay Streets and the intersection of Voltaire and Bacon Streets, conditional upon regular operation of the new high-speed railway service and regular operation of a bus service.

Will Pay Tax.—The Denver Tramway, Denver, Col., is ready to pay to the city of Denver the $205,000 awarded the city by the decision of the United States Court of Appeals, St. Louis. The amount is the accumulation of the $5,000 a month franchise tax the tramway agreed to pay the city, and did pay up to the time the company went into the hands of a receiver.

Bus Supplants Railway.—Unless the city of Greeley, Col., grows very much larger it is doubtful whether there will be any more tramway service provided for its residents. The line which did operate there, known as the Greeley & Denver Railroad, suspended service some time ago because it was unable to meet expenses. When it was found that the tramway could no longer continue, F. E. James, a local automobile dealer, started a bus line with twenty vehicles. The railway did likewise, and for some months both the James Company and the railway gave bus service, but the railway finally withdrew its vehicles. The tracks, trolley and all the equipment formerly used by the Greeley & Denver Railroad has been sold as junk to M. S. Radetzsky, Denver.

Board of Trustees Appointed.—The Selectment of Athol, Mass., have appointed a board of five trustees to manage the Athol & Orange Street Railway, which is to be put under town management in about a month.

$548,020 Taken to Meet Board Payments.—The operating fund of the Seattle Municipal Railway was recently invaded to the extent of $548,020, to help meet the railway's bonds and interest payments, due on March 1. This leaves a deficit of $80,000 in the operating fund, which will be shortly repleted by daily earnings. Payment on the principal on March 1 is $833,000. The interest payment due then is $363,100. This makes the total payment $1,196,100.

Denies Company Is Negotiating for Tulsa Lines.—J. A. Frates, vice-president of the Oklahoma Union Railway, Tulsa, has advised the press that reports to the effect that his company is negotiating for the purchase of the lines of the Tulsa Street Railway are in error. Rumors in Tulsa and elsewhere have had it that the Oklahoma Union was a bidder for the Tulsa property.

Receiver Appointed.—J. H. Bridgers has been named receiver of the Alamance Railway, Burlington, N. C. The line connects Burlington, Graham and Haw River. It has been operating 8 miles of line.

Seeks to Abandon.—The Pacific Electric Railway has applied to the California Railroad Commission for permission to abandon service on its Laurel Canyon line in Sunset Boulevard, Hollywood, from Gardner Junction to the end of the line. The Los Angeles Motor Bus Company, which is controlled by the Pacific Electric Railway and the Los Angeles Railway, has placed in operation on that route service with ten-minute headway.

Traffic and Transportation

Last Fare Hearing in Atlanta

The fifth and for a time the last public hearing of the Georgia Railway & Power Company on its petition for increased fares and the elimination of jitneys was held on Feb. 6.

Sam Schlesinger, head of the Atlanta Jitney Bus Association, had figures to show that the jitney operators were paying into the city treasury in taxes an amount equal to more than 3 per cent of their gross income. Seven-cent fares for jitney buses instead of the present 10 cents, with a possible reduction in fare to 5 cents later on, were promised by Mr. Schlesinger on behalf of the jitney association. Mr. Schlesinger also commented upon the new line of Brown buses, which started recently to operate from the Brookwood Station on Peachtree Street to the central portion of the city.

Eugene C. Calloway, prominent Atlanta business man, spoke in favor of the fare increase, pointing out that if the railway was unable to extend its lines so as to serve the suburbs of the city, this would result in higher rents and greater congestion in the downtown area of the city, a condition every one was trying to avoid.

Indications are that this will be the last public hearing held on the proposed rate increase for from ten days to a week, when the report of the City Council's auditing committee will come up for discussion. If the report of the auditing committee shows the financial condition of the company to be substantially as stated in the petition, it will settle matters for the Georgia Railway & Power Company in the public mind. The company is asking for an increase in fare from 7 to 10 cents, for the privilege of asking 2 cents for transfers, and for the elimination of jitneys from the streets on which its lines are operated. Unless these things can be secured, the company has warned the public that it cannot make any extensions or improvements in its service, and may be forced to cease operation.

John A. Beeler, consulting engineer, New York, has been employed by the city of Atlanta, Ga., to make a general traffic study looking toward relief of congestion and more effective operation of the street cars. He is employed by the city and will report to the city, but the Georgia Railway & Power Company has agreed to pay for the work.

Five-Cent Fare in Washington Declared Ruinous

The Public Utilities Commission of the District of Columbia recently struck several body blows at the proposal for a 5-cent fare in the District in a letter dispatched to Senator L. Heisler Ball, chairman of the Senate District committee. The high light of the letter is a statement of figures showing that the two railways of the District would have lost a total of more than $1,000,000, even if they did not have to pay taxes, had a 5-cent fare been in effect during the past year.

The letter was written by the District Commissioners as a report on the Senate bill which would prohibit the Public Utilities Commission from fixing rates of fare for railways in excess of those stipulated in their charters. Since the 5-cent fare is stipulated in the charters, the bill would by such wording make the 5-cent fare the maximum in the District.

The letter declared that the effect of a cash fare of 5 cents with tickets at the rate of six for 25 cents, as provided by the terms of this bill, would be ruinous to the railways, and disastrous to the efficient service now furnished the public by those local corporations.

Arrangements Made for Bus Service in British Columbia

De luxe motor bus service will be given between Vancouver and New Westminster, 12½ miles distant, by a company to be formed by the British Columbia Electric Railway and which will be known as the British Columbia Rapid Transit Company. The new company will have a capital of $500,000.

There is at present an interurban line operated by the railway between the two cities, on which a twenty-minute service with multiple-unit trains is given. For many years jitney service has been competing on the highway paralleling the interurban line.

The British Columbia Electric Railway has now decided to operate de luxe buses between its own terminals, probably on a twenty-minute headway, in competition with its own railway. Details as to number of buses, fares to be charged, etc., have not yet been arranged. At present the railway fare is 35 cents return, whereas the jitney fare is 70 cents return.

Rerouting in Davenport Proves Effective

Tri-City Railway Gives Better Service Following Track Abandonment and Construction— Ten-Cent Fare in Effect

A COMPREHENSIVE rerouting of electric railway lines in Davenport as a means of meeting present-day conditions, lowering the cost of operation, eliminating parallel trackage, providing for future expansion, cutting out loops and giving better service has been put into operation by the Tri-City Railway of Iowa and is proving its practical efficiency despite the severe handicaps of heavy snows and cold which accompanied the change.

The total cost of the rerouting is $102,000, of which $77,000 is for new tracks and passing tracks and $25,000 for track abandonment. The plan was approved by the City Council after months of negotiations and was accompanied by a change in fares. Instead of the old 8-cent flat fare a new cash fare of 10 cents was put into effect, with the provision of sale of tickets at the rate of three for a quarter and fifteen for a dollar. The sale of the tickets at the rate of fifteen for $1 has been heavy since the rerouting went into effect and the average of fares has not been quite as high as the city had estimated. The fare arrangement is a tentative one and according to an ordinance provision may be changed this summer if it is found that the revenues of the company do not provide a sufficient return on the investment.

One of the features of the new system of operation is more frequent service during the peak hours. When the old schedule provided for a fifteen-minute service throughout the day and early evening, the new schedule betters this service considerably by furnishing a ten-minute schedule during the rush hours. On main trunk lines through the business district ten-minute schedules have been raised to seven and one-half-minute intervals and seven and one-half to five-minute intervals during the rush periods.

The Davenport system had originally been built up by competing companies and had never been completely revised. Some changes for the better had been made, but before the recent changes were put into effect the company had never been able to convince the conflicting interests, business and residential, that a comprehensive revision of lines and schedules should take place. Individual lines furnished a fifteen-minute interval of service throughout the day, with some trippers during peak hours. Service on separate lines could not be co-ordinated on the main line tracks and this caused "fleeting" of cars during certain periods. The company was confronted yearly with city paving programs which required large expenditures for track paving. This great expense made it necesary to work out a system which would retain only the track necessary to give ample transportation needs for the present and to provide for future expansion.

In working out a comprehensive rerouting plan the officials of the Tri-City Railway sought to:

1. Cut out all loops at end of lines to provide for future extensions and economize in operations.
2. Pair lines which provide the maximum of through trips without transfer.
3. Route lines to operate through the business district instead of looping.
4. Retain lines which will provide service, with maximum walking distance of three blocks in so far as topographical conditions and present property will permit.
5. Establish main trunk lines for business district operating two or more lines over the same track, branching out into the residential districts at the ends.
6. Regulate the length of branch lines so that an equal interval of service can be maintained on trunk lines.
7. Vary the interval of service on lines to meet the demand.

To carry out these principles extensive track changes were necessary and these included track abandonment, construction of new single track and construction of new passing tracks. Four

miles of track, duplicating lines and overextended lines were abandoned. One-half mile of new single track was constructed to connect sections of old lines and eight passing tracks were installed.

The completion of the project is marked by public good will, due largely to the method in which the negotiations with the city were conducted. The project was announced in a series of newspaper advertisements in which all angles of the proposition were explained. It was also discussed by various civic bodies, and the City Council and traction company received the benefit of suggestions from the public through these civic organizations.

Company Paper Fulfilling Its Mission

Baltimore Trolley Topics, published by the United Railways & Electric Company, with the January issue entered upon its eighth year. The management is enthusiastic over the extent to which this little paper has fulfilled its mission, which is accounted for largely by the high tone the publication has preserved consistently. While each issue of the publication is quite naturally given over to current news, the file of the paper does afford a good news if not technical record of the history of the principal doings of the company.

Additional Time for Improvements at Schenectady

There was a hearing on Feb. 7 before Public Service Commissioner Van Voorhis upon the petition of the Schenectady Railway for an extension of time in which it is to comply with the terms of an order issued by the commission last September directing the railway to make certain improvements and additions to give better service.

It was stated on behalf of the railway that orders had been placed for ten new modern city cars and that it has been promised the cars would be delivered some time between March 15 and March 30. The company asked that the terms of the order last September be extended until June 1. President E. M. Walker said the service is now apparently satisfactory and that instead of receiving letters of complaint the company is in receipt of commendatory communications.

It was further stated that a company would at once apply to the Common Council for franchises for authority to operate two bus lines to serve as feeders to the Schenectady Railway with transfer privileges between the trolley and the bus lines. The lines are to be known as the Bellview and Mount Pleasant lines. In this connection the Schenectady Railway Bus Line, Inc., has been incorporated for a period of fifty years with a capital of $30,000.

The hearing was closed with the understanding that prior to June 1 the company will submit a detailed report of the improvements ordered by the commission.

The ultimate effect of the understanding arrived at will probably be to stay the proceedings now pending in the Supreme Court to penalize the railway for failure to comply with the commission's order. This proceeding antedated Mr. Walker's assumption of the presidency of the company.

New Trains and Faster Runs on Illinois Traction System

Four fast trains have been added to the daily schedule of the Illinois Traction System between Springfield and Danville. This is the outstanding feature of the general change in schedule which went into effect on Jan. 13.

Where the previous running time between Springfield and Danville of the regular limited trains was five hours and five minutes, the four new trains will each make the run in four hours and fifteen minutes, cutting fifty minutes from the running time on the 120 miles between terminals. The trains leave each terminal at 9 a.m. and 1 p.m.

Four fast trains daily have also been introduced on the Peoria-Bloomington-Decatur Division.

The 9 and 11 p.m. trains out of Springfield, Champaign, Danville and Decatur have been consolidated into one train, leaving each of these points at 10 p.m. Where consolidation of evening trains has taken effect, it is due to paralleling hard roads and the resulting increase of automobile travel, which during the past years has made increasingly heavy inroads on the passenger business of railroads in general. Traction operating officials have endeavored to consolidate the late evening trains with a minimum of inconvenience to the railway passenger.

Other changes between Danville and Springfield are of minor nature and consist mostly in shortening the running time where possible.

Wants Jitneys Under Commission Control.—Clinton Q. Richmond, president of the Berkshire Street Railway, Pittsfield, Mass., has petitioned the Massachusetts Legislature for an act to place all "jitney" buses under the control of the State Department of Public Utilities, in pursuance of a recommendation made by that department in a recent report to the Legislature.

Increase in Fare Allowed.—An increase of fare has been granted the Texas Electric Railway by the City Commissioner at Sherman, effective on Feb. 15. The former fare was 5 cents. The new fare is 7 cents with four tokens for 25 cents.

Railway and Bus Co-operate.—C. W. Richards, general passenger agent of the Denver & Interurban Railroad, Denver, Col., who has just returned from Chicago, says that plans have been arranged which will permit through passengers a ten days stop over in Denver. Denver & Interurban has completed arrangements with the Glacier Automobile Company whereby a ticket can be purchased at Denver, the various coupons attached being honored by the Glacier people for various trips "on the side," these trips to be made via bus or automobile. During the summer season the Denver & Interurban will run daily cars from Denver to Eldorado Springs.

Overhead Registers in Use.—The use of tokens and also of hand registers has been abolished on cars of the Northern Massachusetts Street Railway running east of Athol fair grounds to South Gardner, Baldwinville and Templeton, effective Feb. 4. Overhead registers have been installed.

Eight Cents Allowed.—The Ogdensburg Street Railway, Ogdensburg, N. Y., now operated by a receiver, has been given permission by the Public Service Commission to charge an 8-cent cash fare in Ogdensburg, in place of a 7-cent fare. The company is further permitted to sell five tickets for 35 cents and to charge school children during certain hours on school days a fare of 5 cents. It was shown at the hearing before the commission that the revenue per car-mile was less than on any other system in the state, except on a line near Buffalo, also in the hands of a receiver, and on a line on Long Island which recently suspended operations. The evidence submitted showed that based on actual operations for nine months and three months estimated the company in 1923, after paying its operating expenses and taxes, had a balance of $2,984, or a return of less than 1¾ per cent on the value of its property.

Bus Bills Introduced—Two bills were introduced in the New York Legislature on Jan. 30 to permit cities to own, operate or lease bus lines. Under a measure sponsored by Assemblyman McCarthy, New York City would be authorized to establish bus lines with a fare not to exceed 5 cents, under the management of the Commissioner of Plant and Structures. Senator Lacey proposes adding a new section to the transportation corporations law permitting cities to own or operate bus lines without obtaining a certificate of convenience and necessity from the Public Service Commission.

Will Extend Bus Service. — The Connecticut Company will extend the Brooklawn-Ash Creek bus service in Bridgeport during hours of heavy travel. The extension will cover Tunxis Hill Road to Knapps Corner.

Buses in Operation. — Three new buses purchased by the Birmingham Railway, Light & Power Company as permanent equipment are now in service in Birmingham. The last of the three was put in service on Feb. 7 on Milner Heights and the other two went into service several days ago on Avenue F. All three buses are operating as extensions of car lines in territory which formerly had bus or jitney service which was discontinued under the settlement ordinance adopted by the city, by which jitneys were banned. A fourth bus is held in reserve for emergency. Transfers are given from the buses to the cars and from cars to the buses. The regular 2-cent transfer charge is made. The four new buses take the place of three which were leased for temporary operation some time ago.

Fare Increase Wanted in Petersburg.—Officials of the Virginia Railway & Power Company have addressed the City Council at Petersburg, Va., stating that the company plans to apply to the State Corporation Commission for an increase in fare in Petersburg. The Petersburg City Council has been asked to recommend a change from 5 cents to 6 cents cash, with five tickets for 25 cents, on the ground that the members of this Council are familiar with the needs of the property.

Will Run Free Buses.—In a movement for a reduction of interurban fares to Culver City and Palms, Cal., the commuters of those two centers have decided to operate two free buses and 200 motorists have agreed to take machine loads of passengers to and from work. For some time an effort has been made to persuade the Pacific Electric Railway, Los Angeles, Cal., to lower rates. When this was unsuccessful, the free-bus plan was decided upon. At a recent meeting attended by civic leaders, the sum of $3,000 was pledged to pay for the buses. Another $5,000 has since been contributed. As no fare is to be charged, the buses can be operated without a franchise from the State Railroad Commission.

One-Man Cars on New York Interurban.—One-man cars have been installed on the interurban line of the United Traction Company between Albany and Cohoes. There are two 7-cent zones on this line and they overlap each other to take care of the local traffic out of the two cities. The passenger riding beyond the limits of the one-fare zone on entering the car receives a colored slip, which is surrendered on his exit. Those passengers riding within the zone receive no slip.

Will Start Another Bus Line.—The Boston Elevated Railway will establish a bus line between Everett Square, Dorchester, Mass., and Head House, City Point, South Boston. General Manager Dana has been authorized to make the final arrangements by the trustees of the company for the bus line, which the company plans to operate from May 30 to Oct. 12.

Reduction Approved. — The Public Service Commission has approved the reduction in book rates from $5.50 to $5 on the Rochester, Lockport & Buffalo Railroad line between Burrows Street, Rochester, and Lockport terminal. The book contains 200 miles of transportation. The reduction became effective Feb. 1, 1924.

Fare Increased.—The Philadelphia & West Chester Traction Company, Upper Darby, Pa., has announced an increase in fare, beginning Feb. 27, when the zone fare will be 7 cents instead of 6 cents, with four strip tickets for a quarter. Increased cost of maintenance, in view of recent extensive improvements, is given as the reason for the increase. The lines affected are those to West Chester, Ardmore, Media and Sharon Hill.

Six-Cent Fare Not Sufficient.—J. E. Zimmerman, president of the Penn Central Light & Power Company in a recent address before the Lewistown, Pa., Chamber of Commerce said that the Lewistown & Reedsville Electric Railway earned only 3 per cent on its investment during 1923, and that it was necessary to increase the fares from 6 cents to 7 cents. He showed that during the period from 1918 to 1923 inclusive the increase in income of the company, operating between those towns, was only $22,000, or less than $4,000 a year, while the increased expenses of operation was $60,000, or $12,000 annually. The gross revenue of the company averaged $150,000 a year. A 7-cent fare would provide $24,000 additional revenue annually.

First Bus to Be Operated.—The Fitchburg & Leominster Street Railway, Fitchburg, Mass., has received its first new bus. It will be used to make the trip from Fitchburg center to the Burbank Hospital.

Passenger Identification Checks.—In the new front entrance, center exit surface cars on the lines of the Brooklyn City Railroad the passenger pays as he passes the conductor, who is stationed in the well at the center. In order to facilitate passenger movement and add to the convenience of the passenger conductors have been supplied with identification checks which are handed by the conductor to passengers who have passed him and stand in the rear of the car and then discover seats vacant in the front end among the passengers who have not yet paid their fares. When the passenger who holds the identification check leaves the car he returns the check to the conductor.

Straight Ten-Cent Fare Asked.—The Fitchburg & Leominster Street Railway, which connects Fitchburg and Leominster, Shirley, Lunenburg and Ayer, has filed a request with the State Department of Public Utilities for a tariff canceling sale of tickets, allowing 8⅓ cents per ticket, and establishing a straight 10-cent fare.

Buses Will Serve on Carless Routes.—Plans have been completed by the Houston Electric Company to place six twenty-nine-passenger buses in service in Houston, Tex., on April 1 on a route that is not served by street cars but which has been served for a long time by private jitney lines. The date set is the time for all jitneys to cease business in Houston under the terms of an ordinance instituted by the voters of the city at a recent election. The new line will traverse Austin, Holman, Crawford and McGowen Streets.

Bus Line as Feeder Started.—The Eastern Texas Electric Company, Beaumont, Tex., has started a bus line from Port Neches to Nederlands, as a feeder for its interurban line now operated from Beaumont to Port Arthur. Buses seating twenty-five passengers are in service on regular schedule to meet cars of the Beaumont-Port Arthur service.

Plans Bus Line.—The Portland Railway, Light & Power Company, Portland, Ore., plans the establishment of a bus line over the Ross Island bridge to accommodate a territory not now served by the railway. President Franklin T. Griffith has asked City Commissioner Mann, in charge of public utilities, for a conference on the subject. Commissioner Mann stated that as long as the company complied with the provisions of the motor bus law no objection would be had by the city to the operation of the line. The City Council will permit no street car lines to pass over the new Ross Island bridge.

Transfer System Simplified.—One of the first steps under the new management to simplify the transfer system of the Pittsburgh Railways, Pittsburgh, Pa., was the announcement that restrictions limiting the issuance and acceptance of crosstown transfers to the city line would be lifted. Under the new regulations, the transfer to a crosstown car will be issued on a fare paid within the first fare zone and upon transfers received from shuttle lines within the first fare zones. Transfers received from the crosstown route are to be given to the limits of the first fare zone and for transfers to shuttle lines within the first zone.

Orders Change in Fare.—The California Railroad Commission recently decided that the fare and commutation charges of the San Francisco-Oakland Terminal Railways between San Francisco and Piedmont were unjust and unduly discriminatory. The commission has therefore ordered the railway to submit for its approval a tariff for passenger fares, removing the discrimination. The city of Piedmont had filed a complaint against the railway alleging that the one-way and commutation fares between San Francisco and Piedmont were higher than the fares between San Francisco and Berkeley.

Referendum to Decide Fare.—The City Council of St. Catharines, Ont., has decided to submit to the taxpayers of the city the application of the Canadian National Railways to raise its local fares from 5 to 7 cents. The date of the referendum has not been fixed. The Canadian National also has petitioned the City Council for exemption from local taxation and relief from paving between its tracks in St. Catharines. It also has asked for permission to increase its fare from 5 cents to 8 cents on its line to Port Dalhousie from St. Catharines. The Port Dalhousie Council opposed the proposed increase.

Book Review

Alternating-Current Armature Winding

By Terrell Croft, consulting engineer. McGraw-Hill Book Company, Inc., New York, 1924. 352 pages, illustrated.

This is a practical book on the principles and methods of winding and rewinding alternating-current motors. It is written for the practical man, and there is no mathematical treatment of armature winding save a few examples that have been worked out for specific cases. The book is well illustrated, and the latter half is given over completely to induction motor connection diagrams. This book should be of value to the electric railway shop man who has occasion to rewind alternating-currrent motors.

Personal Items

C. D. Smith Made General Manager

Former Superintendent of Transportation at New Brighton Appointed to Succeed W. H. Boyce

Clinton D. Smith has been appointed general manager of the Beaver Valley Traction Company and the Pittsburgh & Beaver Street Railway with headquarters at New Brighton, Pa. He succeeds W. H. Boyce, who became commercial manager of the Pittsburgh Railways on Feb. 1.

Anticipating that Mr. Boyce would leave the Beaver Valley when the Pittsburgh Railways were discharged from

C. D. Smith

receivership, Mr. Smith accepted the position of superintendent of transportation at New Brighton eight months ago and has had the advantage of that advance experience on the property. Before going to the Beaver Valley, Mr. Smith was general superintendent of the Pennsylvania-Ohio Electric Company, Youngstown, Ohio.

One of the younger men in the railway industry, his advancement has been rapid. Completing a special engineering course, he became traffic investigator for the Public Service Railway of New Jersey. He remained with the Public Service until 1916, when he accepted a position as superintendent of traffic and schedules with the Pennsylvania-Ohio Electric Company, Youngstown, and was later promoted to superintendent of transportation, then to general superintendent.

The selection and appointment of Mr. Smith as general manager of the Beaver Valley Traction lines was made by E. E. Hamilton, vice-president in charge.

Mr. Smith was born in Harrison, N. J., on June 27, 1888. He was educated in the public schools and matriculated at the Worcester Polytechnic Institute, Worcester, Mass., graduating in the department of electrical engineering in 1912. Immediately after graduation he entered the railway engineering course of the Public Service Railway and pursued the study of operation until 1916.

Mr. Smith is a member of the committee of the American Electric Railway Transportation & Traffic Association on the merchandising of transportation and is a strong advocate of the need for railways to give a complete service upon a basis of selling the rides furnished and having the convenience, surroundings and equipment of a standard to justify their sale and purchase.

As general superintendent of the Pennsylvania-Ohio Electric Company he was one of the first in the industry to recognize the possibilities of the motor coach for providing service in districts where the expenditure of constructing and maintaining electric lines would not be justified. Largely as a result of his advocacy of the use of the bus many communities in Youngstown and adjacent thereto have frequent motor coach service which gives to the residents access to all parts of the city and surrounding territory through transfer to the electric lines.

Mr. Viergever and Mr. Degener Advanced with Michigan Properties

At a meeting of the directors of the Michigan Electric Railway, Michigan Railroad, Grand Rapids, Holland & Chicago Railway and the Lansing Southern Railroad on Feb. 4, Niel M. Viergever was elected secretary of the companies, as well as a director of all except the Michigan Electric Railway, and O. H. Degener, who has been acting in the capacity of assistant treasurer, was elected treasurer of the companies. J. W. Glendening, former secretary and treasurer, resigned to accept a position in the East, announcement of which will be made later.

Mr. Viergever has been with the Grand Rapids Railway for the past eighteen years.

Mr. Degener has been with the Michigan Electric Railway, successor of the Michigan United Railways, in various capacities, for the past seventeen years, having entered the employ of the Michigan United Railways in 1907, filling various positions until he was elected to his present one.

Mr. Glendening went to Jackson with Mr. Collins, as his assistant and as treasurer of the companies under his management, at the time Mr. Collins became vice-president and general manager of the Michigan United Railways and the Michigan Railway in 1912. In 1919 he was elected secretary of the company and for the past year and a half has held the position as secretary and treasurer. Previous to that time, from 1907 to 1912, he was with the companies operating the railway, electric and gas properties in Saginaw and Bay City.

T. T. Parker Made Vice-President

An innate love for things electrical in his youth in a small Illinois town, growing through high school days in Kansas and finally landing him near the top as vice-president and general manager of the Dubuque Electric Company has been the career of T. T. Parker. Until recently he has been general manager of the company.

Mr. Parker's first real electrical work was a four-year course at the Kansas State Agricultural College at Manhattan, in 1907. Then he set poles, strung wires, sold power and did a multitude of other things.

He was with the Kansas Electric Utilities Company at Parsons for two years as a power salesman and commercial manager. Then he went to the Union City (Ind.) Electric Company as manager. He was there for a three-year period. His first appointment as general manager was at Emporia, Kan., with the Kansas Electric Power Company. He was in charge of the Em-

T. T. Parker

poria division, embracing five counties. By his activity there a non-paying railway line was made productive through discontinuance of cars and the substitution of buses.

Walter S. Wyman has been made president of the Central Maine Power Company, Rockland, Me. In 1899 Mr. Wyman was elected general manager of the Waterville & Fairfield Railway & Light Company with offices at Waterville, Me. He held this position until June, 1901. Mr. Wyman's connections have been almost entirely in the lighting and power fields.

John Carl, storekeeper at the Chestnut Street shops of the Indiana Service Corporation, Fort Wayne, Ind., for the last eight years, has been assigned to special work at the Spy Run power station in connection with the installation of new equipment. Erwin Firestine, who has been assistant storekeeper, has succeeded Mr. Carl as storekeeper.

Ernest Barker, formerly master mechanic of the Charleston Consolidated Railway & Lighting Company, Charleston, S. C., resigned Feb. 1 to accept the position of general foreman with the Georgia Railway & Power Company at Atlanta. Previous to Mr. Barker's connection with the Charleston property

he served five years in charge of equipment for the Public Service Railway at Edgewater, N. J. Mr. Barker has had extensive experience with the Interborough Rapid Transit Company and general electrical experience in many branches. His early education was received in the schools of England, where he was born.

H. C. Donecker has resigned from the Public Service Railway, Newark, N. J. He had lately been assistant to Vice-President E. W. Wakelee. Before that he was assistant general manager of the company. Mr. Donecker went to the Public Service Railway in 1913 from the post of secretary of the American Electric Railway Association. He has been engaged in street railway work since 1890, both in the operating and manufacturing ends.

Patrick Troy has been appointed shop foreman of the New York & Queens County Railway, Woodside, N. Y. Mr. Troy had until recently been general foreman of car repairs of the Third Avenue Railway System. He has been engaged in work in the street railway field in New York City since he entered the employ of the Metropolitan Street Railway in 1897.

William I. Whitefield is now electrical engineer of the Roanoke Railway & Electric Company, Roanoke, Va. He replaces W. G. Clayton, who was assistant general manager and electrical engineer.

Halbert O. Crews, appointed to take charge of general publicity work for the Chicago Surface Lines, assumed his duties on Feb. 4. Mr. Crews went to Chicago from Springfield, Ill., and entered the utility field with a broad background of newspaper and publicity experience. He was managing editor of the Springfield *News Record* from 1913 until that paper was sold in 1919 and suspended publication. In 1918 he was publicity manager for the Illinois Centennial Commission and has since been engaged in general editorial and publicity work. As superintendent of reports for the State of Illinois in 1920 and 1921, he edited all state reports prepared during that period. During the recent campaign for a new constitution in Illinois Mr. Crews, as secretary of the committee on submission, was in charge of publicity. He has also edited the last four blue books, which are issued every two years by the Secretary of State.

Willard F. Graves has been appointed chief engineer of the Terre Haute, Indianapolis & Eastern Traction Company, with headquarters at Indianapolis. Mr. Graves was formerly for nine years chief engineer of the Montreal Tramways. He has also been connected in the past with the South Side Elevated Railway, Chicago, and the Chicago City Railway and has acted in a consulting capacity at various times for the Detroit United Railway, the Halifax Tramway & Power Company and the Quebec Railway, Light, Heat & Power Company. He has served as chairman of the committee on way matters of the American Electric Railway Engineering Association. A portrait and a biography of Mr. Graves were published in the ELECTRIC RAILWAY JOURNAL for Dec. 1.

M. H. Frank Has Had Varied Career in Utility Field

M. H. Frank, the new manager of the electric railway department of the Eastern Wisconsin Electric Company, at Fond du Lac, Wis., has had many and varied experiences in the utility field. His earliest connection dates back to June, 1908, when for G. W. Thornton & Sons, in Elkhart, Ind., he operated a traction engine for a threshing outfit. He later served with the Fort Wayne Electric Works, in Fort Wayne, and still later with the Indiana & Michigan Electric Company as assistant construction engineer, and then as resident engineer. In September, 1913, he became identified with the Fargo Engineering Company, in Jackson, Mich., as assistant testing engineer.

From June, 1916, to April 15, 1918, he was associated as operating engineer with the Galesburg Railway, Lighting & Power Company in Galesburg, Ill. In this capacity he had direct charge of all construction work. He also managed the city railway and interurban railway systems, along with

M. H. Frank

his work of general operation covering manufacture of electricity and distribution of electricity for light and power purposes. In 1918 he joined the forces of the Eastern Wisconsin Electric Company in Fond du Lac as manager of the gas and electric end of the business, but in 1922 he was made manager of the electric utilities of the Eastern Wisconsin Electric Company, supplying the city of Sheboygan. This placed him in direct charge as manager of all the electric and gas utilities of the Eastern Wisconsin Electric Company. On Jan. 1 of this year, in addition to the above activities, he assumed management of the electric railway lines as well. Mr. Frank completed a four year course in electrical engineering, receiving the degree of bachelor of science in electrical engineering and an advance degree of electrical engineer.

In his new position with the Eastern Wisconsin Electric Company, reference to which was made previously in the ELECTRIC RAILWAY JOURNAL, Mr. Frank succeeds B. W. Arnold.

John S. Allen has been selected by the Madison Railways, Madison, Wis., to fill the position of consulting engineer to that company. For the last three years Mr. Allen has been engaged in consulting engineering practice at Madison. Before that he was a member of the State Railroad Commission for four years. His experience with that body has given him an opportunity to gain a keen interest into the affairs of the company. In his first duties he will deal with relations between the riding public and the company. Mr. Allen will continue his private business.

E. L. Marriage, for the last two years in charge of public relations for the Des Moines City Railway as assistant to F. C. Chambers, president of the company, has been elected to the board of directors of the company. Since Mr. Marriage joined the Des Moines organization two years ago the change in public sentiment toward the company has been little short of remarkable. Mr. Marriage has not hesitated to tell the public of the betterments made by the company in its service and to the physical property. In this work he has used newspaper advertising, car cards and various other media. A little folder placed in racks in the cars every week called the "City Railway News" has been an important factor in this educational work.

C. J. Crampton, formerly superintendent of the safety and efficiency department of the Dallas Railway, has been placed in charge of the newly created public relations department of the company, the central idea of which will be merchandising service. Mr. Crampton has been relieved of all duties in connection with the operation of the Dallas Railway and will devote his time exclusively to the department of public relations, in which he will be the contact man between the public and the railway. As explained elsewhere in this issue of the ELECTRIC RAILWAY JOURNAL, the department of safety and efficiency has been abolished and the safety work heretofore carried on by Mr. Crampton for the company has been turned back to the operating department.

R. W. Curran, formerly general superintendent of the St. Joseph Railway, Light & Power Company, St. Joseph, Mo., has been appointed general superintendent of the Portsmouth Street Railroad & Light Company, Portsmouth, Ohio. This property was recently acquired by the Henry L. Doherty interests. Mr. Curran served a year and a half with the Doherty interests in Denver, following which he worked for a year at Massillon, Ohio, and a year and a half at Elyria, Ohio. Later he spent a year in the New York Doherty office, to be followed by three years service with the Dominion National Gas Company of Buffalo, N. Y. He was identified with the Ohio Public Service Company of Warren, Ohio, for five years. It was from Warren that he went to St. Joseph, where he held the position of general superintendent for a year. As noted previously his place at St. Joseph has been filled by D. C. McClure of Denver.

Manufactures and the Markets

News of and for Manufacturers—Market and Trade Conditions
A Department Open to Railways and Manufacturers
for Discussion of Manufacturing and Sales Matters

$2,146,506 Net for Brill

Car Building Concern Enjoys Good Year —$100,000 Set Aside to Develop Self-Propelled Vehicle Field

For the year 1923 the combined output of the four plants of the J. G. Brill Company amounted, in sales value, to $18,167,486.

The combined output for each of the past six years follows:

1918	$16,761,155
1919	14,210,622
1920	17,537,293
1921	7,647,899
1922	10,177,583
1923	18,167,486

The net profit of the company for the year was $2,146,506 after deducting from the earnings the cost of maintenance and repairs, amounting to $592,035, together with all other charges, and after setting aside out of earnings the following reserves—for depreciation of plant and equipment, $231,148; for federal and state income taxes, not yet due, $347,896; for special depreciation, $150,000; and for development of gasoline-propelled vehicles, $100,000.

CONSOLIDATED PROFIT AND LOSS ACCOUNT OF THE J. G. BRILL COMPANY AND SUBSIDIARIES FOR YEAR 1923

Total net sales billed		$18,167,486
Cost of sales, including operating, selling, administration and general expenses and depreciation for the year		15,525,021
		$2,642,465
Miscellaneous income		101,937
Operating profit		$2,744,402
Less reserves:		
For federal and state income taxes	$347,896	
For special depreciation	150,000	
For development of gasoline - propelled vehicles	100,000	
		597,896
Net profit to surplus		$2,146,506
Earned surplus at Dec. 31, 1922		$3,582,971
Less:		
Adjustments of patents and good will	$199,670	
Miscellaneous adjustments—credit	16,499	
		183,171
		$3,399,800
Add profit as above		2,146,506
		$5,546,306
Less dividends paid:		
Preferred	$320,600	
Common	240,510	
		561,110
Earned surplus at Dec. 31, 1923		$4,985,196

The amount of work on hand at the close of the year was $3,500,000.

Since the organization of the company in 1907, it has been customary, in making the annual report, to show as one item, under "value of properties," the amount carried on the books as representing the real estate, buildings and equipment and an amount representing patents and good will. It was felt that a restatement of this entire account should be made to set forth more clearly the exact condition of the company, and an appraisal was made to determine the present value of the real estate, buildings and equipment owned by the company. It indicated a substantial, increased present value over the depreciated book value. Although the good will and patents are considered to be extremely valuable, the directors decided to reduce their value to the nominal amount of $1 each, and to substitute as far as possible the increased tangible value shown by the appraisal, charging the balance, $199,670, against earned surplus.

Believing that there is an increasing demand for gasoline-propelled passenger vehicles for use both on steam railroads and on the highways, the company has been taking steps to increase the efficiency of this class of transportation equipment and has decided to set aside a reserve of $100,000 for further development of this branch of the business.

Historical Railway Booklet Published

The Westinghouse Electric & Manufacturing Company has recently released a fifty-four-page publication entitled "A brief Outline of the Development and Progress of the Electric Railway Industry." This booklet sets forth briefly the history of the electric railway industry, from the installation of the first permanently fixed rails to the production of the powerful electric locomotives of today. A wealth of illustration, including photographs of modern equipment and sketches of the earliest railway apparatus, adds greatly to the interesting character of the publication.

In the introduction, "Reminiscences of Electric Railway Development," L. M. Aspinwall of the Westinghouse company discusses the early trend of railway motor design and the problems encountered in the development of control apparatus.

Chapter 1 of the booklet includes the evolution of electric railway transportation from 1700 to 1885, describing the various inventions and experiments in the early stages of its history. This chapter is followed by a résumé of the development and service of the Westinghouse company in all branches of the electrical industry.

Chapters 3 and 4 recount the development of railway motors and control from the building of the first double reduction motor to the extensive equipment being manufactured today.

Electric railway history from 1894 to the present is set forth in the next chapter, after which a story of the first interurban railway in the United States is recounted. A discussion of freight haulage by the electric railway and the past and present tendencies of electric railway cars are included in the next chapters.

Succeeding chapters in the publication portray the extensiveness of Westinghouse service and the methods of the company in rendering effective service to its customers through various works, offices, service stations and warehouses, and through engineering studies and many informative publications and advertising programs.

Equipment maintenance and upkeep for electric roads is treated briefly in a four-page discussion of that subject. A short description of the electric railway industry as it is today concluded the publication.

O.B. Salesmen Use the Trolley

When Ohio Brass Company salesmen are called in for their annual sales conference a special car is chartered for their use in traveling between their hotel and the main office of the company where the business sessions are held. This special trolley has become a well-established feature of the annual sales convention. The car is provided in Mansfield by the Ohio Public Service Company. This is just another sample of how manufacturers can cooperate with railway companies—when they stop to think about it.

Manufacturer Charters Car for Use at Salesmen's Meeting

Metal, Coal and Material Prices

Metals—New York	Feb. 13, 1924
Copper, electrolytic, cents per lb	12.75
Copper wire base, cents per lb	15.375
Lead, cents per lb	8.275
Zinc, cents per lb	6.737
Tin, Straits, cents per lb	54.00
Bituminous Coal, f.o.b. Mines	
Smokeless mine run, f.o.b. vessel, Hampton Roads, gross tons	$4.825
Somerset mine run, Boston, net tons	2.25
Pittsburgh mine run, Pittsburgh, net tons	2.00
Franklin, Ill., screenings, Chicago, net tons	1.825
Central, Ill., screenings, Chicago, net tons	1.35
Kansas screenings, Kansas City, net tons	2.25
Materials	
Rubber-covered wire, N. Y., No. 14, per 1,000 ft	$6.60
Weatherproof wire base, N. Y., cents per lb	17.00
Cement, Chicago, net prices, without bags	$2.20
Linseed oil (5-bbl. lots), N. Y., per gal	$0.95
White lead, in oil (100-lb. keg), N. Y., cents per lb., carload lots	11.74
Turpentine, (bbl. lots), N. Y., per gal	$1.00

Rolling Stock

Birmingham Railway, Light & Power Company, Birmingham, Ala., will receive twenty new cars on March 1.

Wheeling Traction Company, Wheeling W. Va., has placed an order with the Cincinnati Car Company at Winton Place, Ohio, for twenty-one new passenger cars.

Los Angeles Railway has ordered 722 Westinghouse type 514-L motors to equip the 120 new cars being purchased and built as a part of the 1924 program. Some of these motors will be used for replacing older equipment now in service. A number of two-motor cars are to be made four-motor cars this year and 100 controller equipment units of type K-35 have been ordered for four-motor cars and 300 type K-68 controllers have been ordered for two-motor cars. The new controllers are to be furnished by the General Electric Company.

New Brunswick Power Company, St. John, N. B., is remodeling and refitting a number of old cars.

Milwaukee Electric Railway & Light Company, Milwaukee, Wis., will soon place in operation between Waukesha and Milwaukee five new buses. The company suffered by fire on Feb. 8 considerable damage to seven of its city cars in its Fond du Lac carhouse.

United Electric Railways, Providence, R. I., recently bought three Fageol safety coaches.

Track and Line

Menominee & Marinette Light & Traction Company, Marinette, Wis., is requesting authority of the Marinette Common Council to install additional overhead and track facilities in Dunlap Square.

Canadian National Railways, Montreal, Que., proposes to spend approximately $500,000 in improvements in 1924 extending its local service in St. Catharines, Ont.

Los Angeles Railway started the extension of the Central Avenue line from the south terminal at the Goodyear plant to Seventy-seventh Street on Feb. 1. This is the second extension started since the first of the year, the other being the extension of the West Ninth Street line from Harvard Boulevard to Western Avenue, where it will connect with the crosstown bus line. The Ninth Street extension calls for ¼ mile of double-track construction and the Central Avenue line will be extended 0.4 mile.

Tri-City Railway of Iowa, Davenport, in line with its comprehensive rerouting program built 1,500 ft. of single track and constructed eight passing tracks in various parts of the city. In the service improvements installed were sixteen Nachod automatic electric blocks at a cost of $15,000 to speed up the movement of cars on single-track lines and six Cheatam electric track switches.

Alabama Power Company, Birmingham, Ala., is rebuilding a number of the trolley lines in Tuscaloosa. Many new rails and new ties are being placed, while some of the grades are being changed. With the exception of a short stretch the work of rebuilding the Holt line is completed and work is now progressing on the loop line. The company recently acquired control of the Tuscaloosa railway system.

Pacific Electric Railway, Los Angeles, Cal., has requested permission to construct a single track at grade across Commercial and Canal Streets in Long Beach.

Power Houses, Shops and Buildings

Ottawa Traction Company, Ottawa, Canada, is constructing a new modern brick and cement building for the purpose of housing a new substation and providing linemen's quarters. When completed and the new substation installed it is expected it will add materially to the effectiveness of the power distribution system.

Virginia Railway & Power Company, Richmond, Va., has purchased four Westinghouse new model multiple retort underfeed stokers and four new 512-hp. B & W boilers to be installed in a new extension to the Reeves Avenue power station at Norfolk, Va. Electrical auxiliaries have also been purchased for the Twelfth Street power house of this company at Norfolk.

Chautauqua Traction Company and **Jamestown, Westfield & Northwestern Railway** will build two automatic substations, according to an announcement by George L. Maltby, general superintendent. The new substation at Stow replaces the one damaged by fire a few weeks ago, and the new substation on the Jamestown, Westfield & Northwestern will be erected at Glenn Ewen, a point about half way between Mayville and Westfield. The portable rotary substation now in use at Westfield will be moved to some point on the Jamestown, Westfield & Northwestern line, probably at Dewittville, Mr. Maltby, indicated. Work on the new automatic substations will start soon and they will be completed and fully equipped and ready for service in four or six months. The substations are to be of concrete, fireproof construction and will be 500-kw.

Trade Notes

United States Light & Heat Corporation, Niagara Falls, N. Y., announces that effective March 1, R. M. Kincaid, who has been works manager since August, 1920, will resign to accept a position with the Garford Motor Truck Company of Lima, Ohio. J. K. Gould will carry on that part of Mr. Kincaid's work which had to do with the manufacture of batteries, his title being superintendent battery division. Otto Von Goeben will carry on that part of Mr. Kincaid's work which had to do with the device and arc welder end of the business, his title being superintendent device division. The corporation manufactures U. S. L. storage batteries, arc welders and train lighting equipments.

Okonite Company, Passaic, N. J., manufacturers of "Okonite" insulated wires and cables, splicing tapes, etc., has recently appointed the Engineering Materials, Limited, McGill Building, Montreal, P. Q., as its Canadian representative.

N. A. Petry Company, Inc., Philadelphia, makers of the Petry Bus Heating System, announces the appointment of E. R. Mason as Eastern sales representative. Mr. Mason has been associated with the Electric Service Supplies Company as Eastern sales manager, and with the Ohio Brass Company as assistant general sales agent. Mr. Mason is located at 1845 Grand Central Terminal, New York City.

Mitchell-Rand Manufacturing Company, New York, N. Y., while essentially maker of industrial and insulating compounds, is also distributor and representative for manufacturers of varnished materials, insulating tapes, etc. Recently the Mitchell-Rand company arranged to act as Eastern distributor for the Plymouth Rubber Company, Inc., Canton, Mass., and now carries in its warehouse at 18 Vesey Street, New York City, a complete stock of Plymouth friction tapes and splice, insuring immediate deliveries at no advance over prices prevailing at the mill. Maurice J. Deegan, who has had extensive experience in the sale of these materials throughout the country, is supervisor of the new tape and splice department of the company.

New Advertising Literature

International Steel Tie Company, Cleveland, has issued a folder entitled "Years Later." It explains how the second rail goes in on a steel tie foundation. The pamphlet tells in detail about a particular track job undertaken for the Cleveland Railway and its resulting revelations as to the wearing qualities of concrete foundations.

Pennsylvania Crusher Company, Philadelphia, has issued Bulletin 1014, illustrating and briefly describing "Pennsylvania" steel-built hammer mills for cement, lime and gypsum plants.

Hisey-Wolf Machine Company, Cincinnati, has issued Bulletin 3016-S describing a new wide swing motor-driven grinder.